REPORT RESUMES

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DEVELOPING HUMAN POTENTIAL THROUGH INDUSTRIAL ARTS, ADDRESSES AND PROCEEDINGS OF THE ANNUAL CONVENTION OF THE AMERICAN INDUSTRIAL ARTS ASSOCIATION (27TH, TULSA, 1965).

AMERICAN INDUSTRIAL ARTS ASSN., WASHINGTON, D.C.

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SPEECHES PRESENTED AT THE CONFERENCE ARE INCLUDED--(1) "TECHNOLOGY AND SOCIAL CHANGE" BY J.H. HOLLOMON, (2) "DEVELOPING HUMAN POTENTIAL IN SPACE" BY J.F. SHEA, (3) "CURRICULUM--INNOVATIONS AND ISSUES, 1965" BY K. WILES, (4) "OPPORTUNITIES FOR INDIVIDUAL DEVELOPMENT THROUGH PROGRAMED INSTRUCTION" BY W.C. MEIERHENRY, AND (5) "AND AFTER THE REVOLUTION" BY J.W. BECKER. TWENTY-FIVE SYMPOSIA CONSISTING OF 90 PRESENTATIONS INCLUDE (1) "INCREASED INDIVIDUAL RESPONSIBILITY AND COMMITMENT ARE NEEDED IN INDUSTRIAL ARTS," (2) "SOCIAL BARRIERS TO THE RELEASE OF HUMAN POTENTIAL," (3) "WHAT STEPS CAN INDUSTRIAL ARTS GROUPS TAKE THAT WILL HELP IN THE TASK OF MAINTAINING A RESPONSIVE CURRICULUM," (4) "WHAT PROVISION CAN THE INDUSTRIAL ARTS TEACHER MAKE TO SAFEGUARD THE INTEREST OF INDIVIDUAL STUDENTS," (5) "CAN THE GAP BETWEEN RESEARCH AND UTILIZATION OF RESEARCH IN INDUSTRIAL ARTS BE CLOSED," (6) "SIGNIFICANCE OF DEVELOPING CREATIVITY AS AN IMPORTANT ASPECT OF CONCERN FOR THE INDIVIDUAL," (7) "THE EFFECT OF ENVIRONMENT ON THE HUMAN POTENTIAL," (8) "PROVIDING OPPORTUNITIES FOR INDIVIDUAL LEARNERS TO REVEAL THEMSELVES," (9) "NEW METHODS OF TEACHING WHICH WILL ENABLE THE INDUSTRIAL ARTS TEACHER TO DEVELOP MORE FULLY OUR HUMAN RESOURCES," (10) "COPING WITH INDIVIDUAL DIFFERENCES WITHIN A GROUP," (11) "A PLAN OF PROCEDURE THAT WILL GIVE EVERY LEARNER AN OPPORTUNITY TO ADVANCE ACCORDING TO HIS POTENTIAL," (12) "TEACHER EDUCATION IN ELEMENTARY SCHOOL INDUSTRIAL ARTS," (13) "DEFINING THE ROLE OF INDUSTRIAL ARTS EDUCATION FOR THE FUTURE," (14) "THE EVOLVING CONCEPTS REGARDING THE TECHNICAL AND PROFESSIONAL COMPETENCIES OF INDUSTRIAL ARTS TEACHERS," AND (15) "TEACHING AND LEARNING IN INDUSTRIAL ARTS." THIS DOCUMENT IS AVAILABLE FOR $3.50 FROM AMERICAN INDUSTRIAL ARTS ASSOCIATION, NATIONAL EDUCATION ASSOCIATION, 1201 SIXTEENTH STREET, N.W., WASHINGTON, D.C. 20036. (EM)

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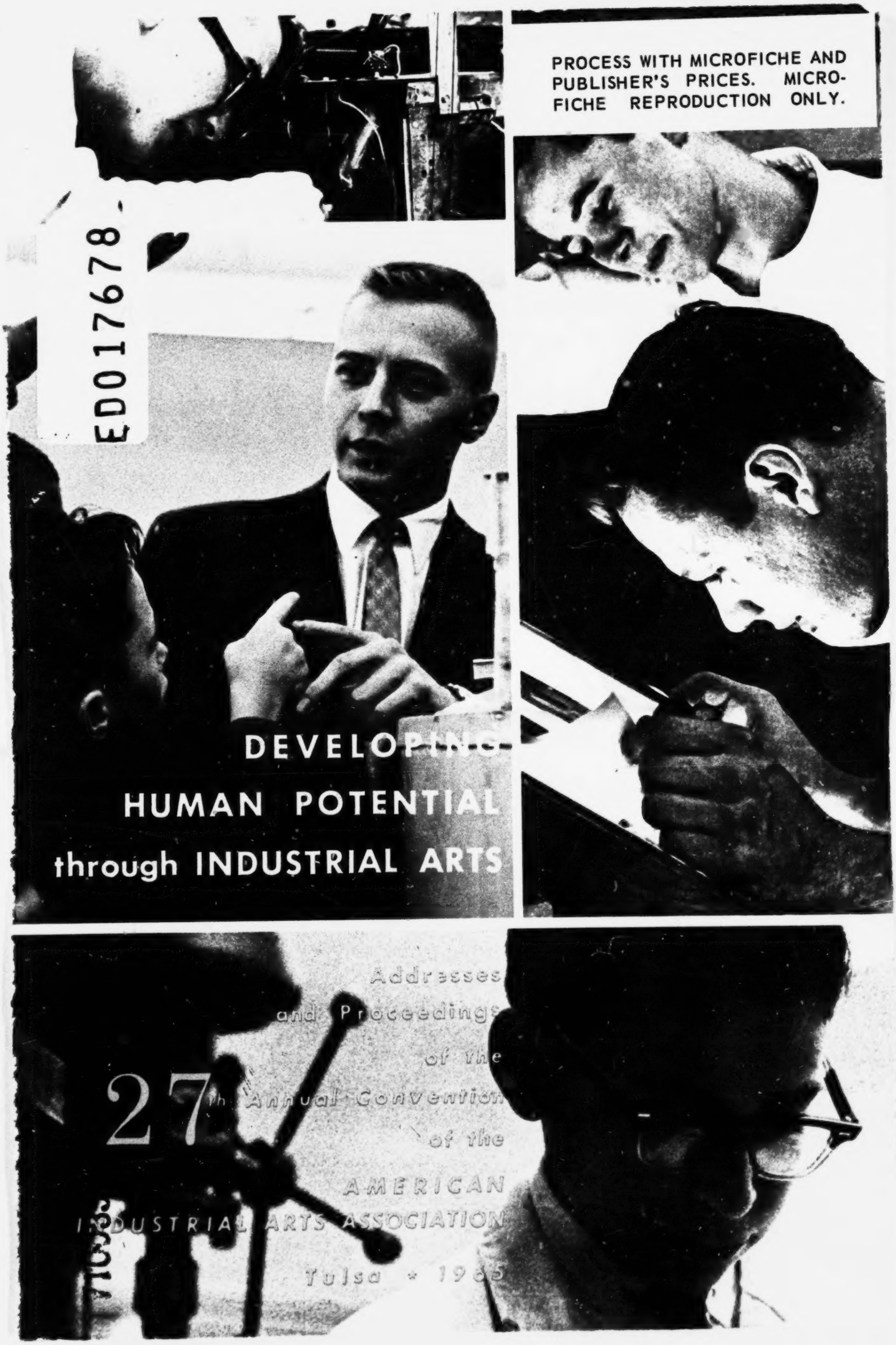

DEVELOPING HUMAN POTENTIAL through INDUSTRIAL ARTS

Addresses
and Proceedings
of the
27th Annual Convention
of the
AMERICAN
INDUSTRIAL ARTS ASSOCIATION

Tulsa * 1965

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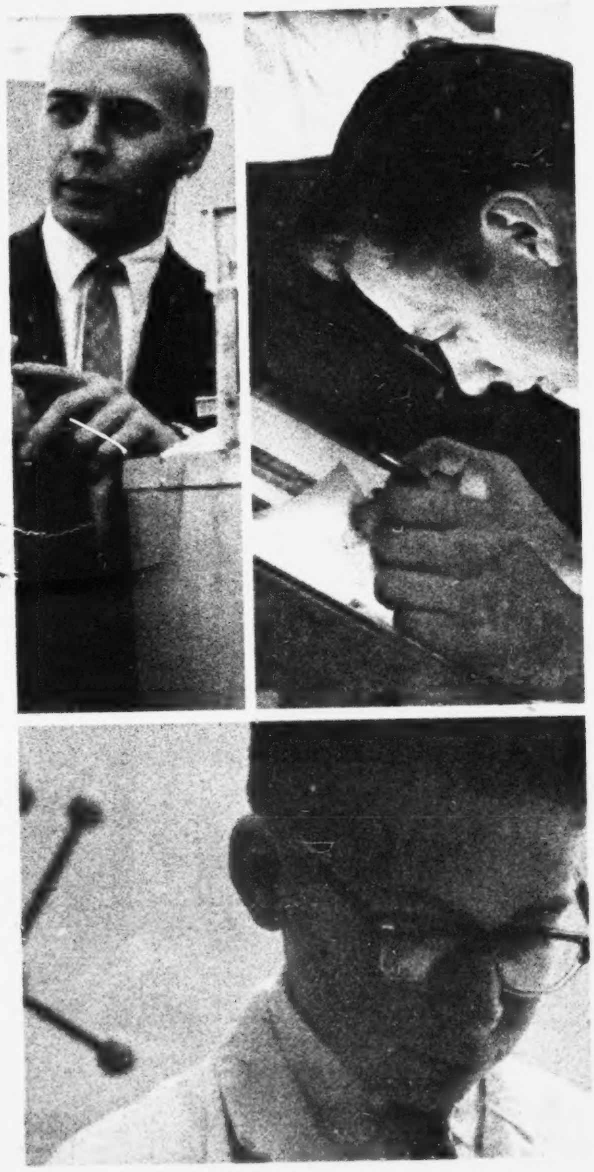

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Tulsa - 1965

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Technology and Social Change

J. HERBERT HOLLOMON, *Assistant Secretary of Commerce for Science and Technology, Washington, D. C.*

The nation's interest and concern with education are coupled with a firm determination to make it a tool for human progress. This concept was symbolized in its highest form by the signing of a land-mark piece of legislation by President Johnson in a country schoolhouse a few weeks ago. The vast changes that have taken place in our country and in the world help put into perspective the sort of education that we must offer to the young people of this country if they are going to function effectively in the future.

The changes I refer to involve technology, that is, the use of science, and social change. This combination of subjects is most appropriate for thoughtful consideration by industrial arts experts. You as educators devote your lives to helping to prepare young people to function effectively in the world, and to develop fully their potential. But, their potential for what? One must take into account the character and nature of the society in which the individual lives in order to develop his potential.

Technology, the field that I represent, is responsible for much of the social change that puts our world in ferment today. Just imagine how much easier your job was for your predecessors a couple of thousand years ago. The rate of social change was then very slow. The knowledge upon which the skills and crafts were based had not changed for hundreds of years. Today, the amount of scientific and technical information doubles every 13 to 15 years. A thousand or so years ago, a teacher could confidently assume that the world in which he had grown up would be essentially the same world as the one which his students would face. Nearly everything he had known, everything he had learned, was meaningful for the next generation, and could properly be passed on as useful knowledge. The situation is entirely different in the mid-twentieth century, both in the United States and in the world at large.

Let's look at the character of the world in which we *now* live and visualize how it's liable to change in the future. The most significant characteristic of modern America is that it is an urban society, an increasingly urban society, where large numbers of people live and work together within a complex social structure. Unless a man or woman has confidence in himself and in his ability, he is liable to be lost in the complexity of modern society.

The second characteristic of our society is that we are an important part of an international world. We are a part of it in cooperative ventures—in the World Health Organization, in UNESCO, in the World Meteorological Organization, and hundreds of others. We are part of a competitive world, competing with the Europeans and the Japanese for economic markets, and competing with the Soviet Union as a political-social-economic system which offers a threat to the very ideas which we honor.

The Soviet Union is committed to the use of science and technology for the benefit of its society. They intend to develop the institutions, educational and research, which will permit them not only to survive in a complicated world, but to provide leadership that the less-developed nations will look to in order to develop their own societies.

The third characteristic of our society is that we are heavily dependent on science and technology. This is evident from the changing character of the military defense system of the United States. Our national defense depends on a commitment of $8 billion, several hundred thousand of our brightest scientists and engineers, and the development of better weapons systems to give us superiority over any potential enemy. The space program uses some of the best talents of the society, the most complicated computer systems, the most sophisticated rockets. We are also a society, and this is a very important characteristic from the point of view of industrial arts, in which the service industries dominate. More people are engaged in manufacturing or agriculture, and that trend will continue as we increasingly apply technology to manufacturing and agriculture. Four or five decades ago half our workers were engaged in agriculture. Now 6 percent of the work force produces all the food and fiber necessary for the rest of us, and supplies part of the needs of the rest of the world. What do I mean by the service industries? I don't just mean the repair business; I don't just mean transportation. I mean education, government, medicine, recreation, and entertainment. The two fields in which there is the most rapid rate of growth of employment and expenditure of the consumer's dollar are education and medicine. And the third most dynamic field is recreation.

This society which I have described has new and different requirements and needs than the society in which you and I grew up.

The first and perhaps most important need is the renewal of the cities, eradicating the slums, and constructing whole new cities. The construction of entirely new cities may become the most significant industrial innovation in our time. Whole cities are being constructed from the ground up. These new cities represent new concepts, in that not only is there living space, but work space, recreation space, service space and open space.

A second need of society today concerns the problem of the environment. Because of the people living in cities, because of the nature of industry, and, to some degree because of our lack of appreciation of the problem, we have polluted our waters to the detriment of recreation, and in many areas of the United States, to the detriment of the potable water supply. We have also polluted the atmosphere, and we have, by various chemical means, caused damage to the life cycle when we sought the benefit of new chemicals such as are used for insecticides. There is an enormous job to be done to correct the abuses.

A third important need of our society is for new and comprehensive transportation systems. Our present transportation system is not only inadequate to meet the requirements of a highly urbanized, industrial society, but it also produces 40-50,000 people killed in the United States and nearly 2 million injured. We must learn to ameliorate these terrible human and economic costs.

These needs, we should note, are not so much individual but social needs, requiring a common effort to get the problem solved. The use of technology to meet these social needs will produce a vast change in our society. Obviously, new skills will be required: computer programmer skills, and technicians' skills. I think there ought to be—in every high school in America—a computer that can be used and taken apart, permitting the language of mathematics to be taught directly to the computer in order to have young people appreciate the power of this tool. There is a need for technical assistants in schools, educational technicians. We also have a vast need for technicians in medicine.

A wide range of skills is needed in recreation. It is not uncommon for the worker in America today to have 3 to 4 weeks of paid holiday in the summer, 7 or 8 days off as individual holidays, and this, with a 40-hour week, or less. The number of hours worked per year is declining. Furthermore, our children are going to work at a later time in their lives. The average age at which young people will be entering the work force will be 20 and 21, rather than 16 and 17, as a few decades ago. People are also retiring early, at 55 and 60, rather than the 65 and 70 of a few decades ago. Thus, less of their lifetime is occupied by work. We have a puritan ethic that work is almost next to Godliness. But we are now reaching a time (except for the culturally deprived and disadvantaged) when the average American will look forward to spending the largest part of his waking time in recreation, rather than in work. This means that he must have things to occupy his mind and his hands—not just ordinary crafts, but highly developed skills of which he can be proud. I think there is an opportunity in America to revive the great skills and ingenuity of the handicraft artist, who engages in such fields as woodworking and metalworking, which we valued so highly in the past.

One hundred years ago, most of the technology of this country was based on the exploitation of material resources and on agriculture. We explored the country; we also established the land grant colleges and the state universities to supply technical people for agriculture. Then, beginning at the turn of the century, and until the 1920's and the 1930's, this country's industry and education were based on energy. We were developing the power system of America. We developed the electrical system—the electrical trolley, the electric light, the electric phonograph, television, and radio. Electricity and mechanical energy became the things upon which we focused our attention, and these subjects formed the bases of technical education in America. Materials and energy, however, will not be the base of technical education in the future. Future education will be based largely upon information, and it will be the manipulation of information which will be the basis of industrial arts in the future—not the manipulation of materials, or energy.

This does not mean that other things are unimportant, but the main thrust of engineering and industrial skills in America will be on information: information handling for insurance companies, for hospitals, for educational institutions, the mathematics of discussion with computers, the languages of commerce, the languages of trade, the display of information for culture, the display of information for command and control systems. All of these will require people who understand, who can use, and who are skilled in the art of handling information. And the language of information handling is mathematics.

We have not done an outstanding job in the past in this country, anticipating the kinds of education and training we needed for our society. If we had done a really fine job, we would not now have so many of our people unemployed. We would not have had to undertake a vast redevelopment program for Appalachia. We might not have needed emergency programs to meet the poverty problems of the United States.

We have never solved this problem on a long-term basis: providing an adequate basis of education, not only for the working skills of tomorrow, but being able to modify those skills, changing them in line with the constantly changing character of our society. Most of the students whom you educate are going to have to work in three or four different fields during their lifetimes. They will therefore have to be renewed for different tasks and re-educated. The children whom you educate will also need imaginative ways for self-expression with the time that lies upon their hands and their minds.

People decry the fact that automation reduces the working time. Yet, man has struggled through the whole of history to remove himself from the burden of poverty, from the need to work, in order to give himself and his children an opportunity to think, and to express themselves. We have not yet solved this dilemma, but education, particularly in industrial arts, can play a leading role in finding the answers.

4

Developing Human Potential in Space

JOSEPH F. SHEA, *Manager, Apollo Spacecraft Program Office, National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Texas*

MY purpose here is to describe briefly the lunar mission and the hardware which will be required to accomplish it, and to attempt to share briefly with you our understanding of the reasons that the program is so important to the nation.

The bases of the manned lunar program are a series of things which we call "space vehicles." A space vehicle consists first, as you may know, of a booster, which is a rocket on the order of the ones we have been firing in this country for years. These rockets in the past have borne names like Thor, Atlas, Titan, and the Minuteman. The ones in our family are called Saturns; and on top of the rockets, we put spacecraft. The program is divided into two parts: the rocket, which provides the thrust or power to get into orbit, and the spacecraft, which, once put in orbit, has to provide all of its own resources, its power, its guidance and navigation, life support equipment, and so on, to sustain the life of the astronauts during the time that they are in space. The vehicle called Saturn I is the vehicle which has been flying at the Cape for two and one-half or three years. It is a two-stage vehicle; it is capable of putting into earth orbit about 22,000 pounds of payload, and it is powered in its first stage by eight engines which in total develop a million and a half pounds of thrust.

The next vehicle, the so-called Saturn I-B, is 221 feet long, can put about 35,000 pounds into earth orbit, over fifty per cent more than the Saturn I, and it has the capability of or will be used for the early earth-orbital testing of the lunar spacecraft. These spacecraft are called the command and service modules and the lunar excursion module. Saturn I-B, which will begin flying in about a year and is now well into its development phase in ground test, will be the work-horse vehicle for the country in what you might call the middle payload range—the range of payloads around thirty or thirty-five thousand pounds; and it is the one in which we'll work out most of the bugs in the Apollo hardware, hopefully, before we're ready to do the lunar mission. The so-called Saturn V is the massive launch vehicle which is being built to provide sufficient payload to get the Apollo spacecraft not just into earth orbit but on the way to the moon. Saturn V is over 360 feet high; the total vehicle weighs some 6 million pounds, is powered (in the first stage) by some five engines, each of which develops a million and a half pounds of thrust, so that the total thrust on take-off is some 7½ million pounds. It will put into earth orbit well over 250,000 pounds. You might get some feeling of the pace at which the space program is moving by thinking of the change in payload from the Mercury to the Saturn V. In the Mercury program, where we used the Atlas, we were limited to a payload capability of about 3,000 pounds. In a period of less than a decade, we will have raised that payload capability to something close to 300,000 pounds—a tremendous increase in payload ability. The spacecraft involved in the program include the "command module," which is just that—the place in which or from which the astronauts command the entire mission. It is a somewhat conically-shaped structure, about 13 feet across the bottom, and about 12 or 13 feet in height. In its cabin three astronauts will ride out to the moon, remain in lunar orbit and then come back from lunar orbit to land on the earth again. Inside, the cabin has room for the three astronauts to lie down side by side on their couches; there is a clear space in the center, straight down from the hatch, big enough that if I stand up in it, the top of my head just brushes the top of the hatch. There are roughly 70 cubic feet per man of available free space in the cabin and that gives some feeling of the amount of room they have to move around in. In the Mercury program the free space for the astronaut was something like 40 or 45 cubic feet. The spacecraft is designed to live in space for a period of time in excess of two weeks. The outer surface is heat shield material—so-called ablation material which protects the crew and absorbs the energy from the deceleration as the spacecraft comes screaming back through the atmosphere. On the top of the spacecraft is the recovery material. It is basically a set of parachutes which are used after coming through the main heat phase of re-entry—the parachutes are deployed and the spacecraft slowly settles to the earth. This, then, is a spacecraft that weighs a little over 10,000 pounds. It carries within it all kinds of communications equipment, life support equipment, guidance equipment, and so on; and it's "home" to three astronauts for a fairly long period of time.

The space stage or space rocket which is used in conjunction with the command module to accomplish the mission is the vehicle which we call the service module, and is intimately joined to the command module. It carries with it the fuel necessary to slow the spacecraft down into lunar orbit and then provide the thrust necessary to bring the spacecraft back out of lunar orbit and home again. The large engine develops about 21- or 22,000 pounds of thrust, very modest by the standards of the launch vehicle. There are four fuel tanks and the vehicle itself is divided into six sectors, four of which are fuel tanks and the other two of which are available to carry the other supplies which are required. The command module and service module are built by the North American Aviation Corporation in a plant at Downey, California.

Another spacecraft, the lunar excursion module, is known affectionately as the LEM or "bug" for short. We are to get to the moon by a method that we call lunar orbit rendezvous, and this involves having a second spacecraft which goes from lunar orbit to the lunar surface. The command-service modules and this spacecraft will all be put into lunar orbit. Then this spacecraft, the LEM, goes from lunar orbit down to the lunar surface with two of the three astronauts who had been in the command module. It performs the mission on the lunar surface and then the upper half of this thing, the ascent stage, then rises from the lunar surface to a rendezvous with the command module in lunar orbit. Basically, then, this is the vehicle which will actually land on the moon. The total vehicle is 20 feet high or thereabouts; it weighs around 32,000 pounds, and is in two parts: The descent stage, which is the lower stage, is primarily fuel, oxygen, etc.; and the engine, which is to be used to go from lunar orbit to the surface. The vehicle will remain on the surface for a period of about a day and a half and then the ascent stage, which contains the cabin in which the crew rides, will then rise from the surface and go back up again. In the center is the hatch through which the crew will crawl out onto the lunar surface. On the top is the hatch to be used for docking with the command module. This is an interesting spacecraft, the first spacecraft designed purely for operation in space. You'll notice that it doesn't look smooth and streamlined; and it never has to re-enter the earth's atmosphere so it doesn't need any aerodynamic smoothing. When launched from the earth's surface, it is to be inside a device called an adaptor, which is a structure which joins the launch vehicle to the command and service modules, and it's tucked away where it never sees the atmosphere as it leaves the earth. It is a spacecraft designed purely for operation in space, and since there's no air out there, no drag, and no need to look streamlined, you can see we've been very functional. If there was an actual bump in the spacecraft we left it there. If we had to stick an antenna on, we stuck one on, and didn't really worry about what it looked like as long as it was performing the right function. This is what you might think of as the "natural look" of a true space-oriented spacecraft.

Before the start of the launch process, the entire vehicle is to be assembled vertically and checked out in the vertical in a building at Cape Kennedy. The building, 525 feet high, is by far the tallest structure in the State of Florida, and is 50 per cent bigger in volume than the Pentagon. The vehicle, once it's checked out in the vertical assembly building, will be put on a device called a crawler and literally trucked down to the pad. The pad is about two miles away and this entire thing will then be moved down to the pad at the alarming speed of about two miles an hour, so the world's fastest chunk of transportation gets a very slow start. In fact the speedometer on that crawler shows maximum limits of something like plus or minus two miles an hour (and they have safety belts on the seats for the driver).

A typical lunar mission which will be launched from the Cape into earth orbit will take about 12 minutes to get into earth orbit. Two stages of the launch vehicle will be consumed, the first and second stages, and the third stage will partially burn to actually achieve earth orbit. Somewhere between one and three orbits or circles of the earth will be spent checking out the spacecraft, being sure that everything survived the boost environment, and then at the appropriate point in time, the launch vehicle engine will be ignited again and about another 7 to 8,000 miles per hour will be gained. It will have been going around 18,000 mph in earth orbit, and will need to be going about 25,000 mph in order to have sufficient energy to coast out to the moon. Once injected, the launch vehicle is no longer needed and the command and service modules will be docked or joined to the lunar excursion module. Basically, the command and service modules under control of the crew go out a little way from the excursion module, turn around and come back, and meet nose-to-nose with the lunar excursion module. Both spacecraft then pull away from the launch vehicle, hooked up as they will be to go out to the moon.

It will take about 67 hours from launch to get out to the moon, so at not quite three days, the spacecraft will swing in towards the moon. In order to be in orbit about the moon, it is necessary to be going about 5,000 mph with respect to the lunar surface. Because of the nature of the orbits it will actually be going closer to 8,000 mph when it arrives out there. It will be necessary as the spacecraft comes in and swings around behind the moon to ignite the big engine on the service module and use it to slow the spacecraft down into lunar orbit, roughly 80 miles above the lunar surface. Once in that orbit, two of the crew members will crawl from the command module through the hatch into the lunar excursion module, turn on the systems in the lunar excursion module, check them out, and after an orbit or two (an orbital period here is roughly two hours), the lunar excursion module will be detached from the command module and start down a trajectory towards the lunar surface. It will coast a little more than half way around after the initial deceleration and then some eight minutes before actual touchdown, the engine on the actual LEM itself will be ignited, and the spacecraft will begin a slow-down process, coming to a hover condition about 100 feet above the lunar surface. The crew can then look out, view the actual landing site and maneuver the spacecraft to avoid any obstacles that may be at the site. The engine is throttlable and after they're satisfied that they have the right landing point, they will throttle back on the engine and, hopefully, descend gently to the lunar surface.

The astronauts can crawl from the LEM out onto the lunar surface, with a back pack that enables them to spend some three hours away from the lunar excursion module itself. The life support equipment will provide a three-hour stay-time capability. They will be able to operate in a radius of about a half-mile from the actual touch-down point. About 250 pounds of scientific equipment is to be carried, and they will be able to bring back from the lunar surface about 100 pounds of lunar material. The initial missions will be primarily scientific in nature, very heavy on the geology side, the picking up of rock samples, the annotating in detail of what's on the surface and probably the implanting of some experiments which will then continue to send data back after the mission has been accomplished. Each crewman will probably be out on the surface at least twice and maybe three times during the stay. The total duration of the stay for first missions will be on the order of a day or thereabouts, with two men on the surface and one still in the command module, orbiting every two hours over the lunar landing point.

When the lunar launch sequence is to begin, the crew will come in, button up the LEM, check out the hardware, and then, at a time which can be computed on board the spacecraft and on the ground, launch will be made from the lunar surface. There will be radar and optical contact between the two spacecraft at that time. The main engine burning, a velocity of about 6,000 feet per second, about 5,000 mph, will be achieved and the lunar excursion module will coast toward the command service module, taking about half an orbit to coast up there again. The two spacecraft will be mutually tracking each other, making any midcourse corrections to make sure that the two will come close together well enough that they will be put almost into the same orbit, at a point where they are less than 1,000 feet apart, with their velocity with respect to each other less than 10 feet per second. At that point in time the crewmen in the LEM will take over and maneuver the LEM into a docking position with respect to the command module. The two spacecraft docked in lunar orbit, the crew will transfer back, bring the lunar rocks and materials back into the command module. They will then disengage the LEM, leaving it in lunar orbit. The service module engine will be ignited and the command module will start to come out on a trajectory, swinging back towards earth. It will take about 92 hours to come back to earth, almost four days instead of the three days it took to go out.

Mid-course guidance corrections can be made to wipe out any errors that may exist in the trajectory, and about 45 minutes prior to actual touch-down, the command module will jettison the service module (it's not designed so that it can re-enter the atmosphere). The command module will be reoriented by the reaction control system; it will come screaming back into the atmosphere at about 25,000 mph, take one major deceleration, actually skip up for a little while, and then come back in for the major slowdown. Once it is through that phase, the parachutes will be deployed and the spacecraft, hopefully, will gently settle to the earth, probably landing somewhere in the Pacific near Hawaii.

The program today stands almost half-way along the path from President Kennedy's decision in 1961 to the actual landing itself. The first year, from 1961 through the middle of 1962, was literally spent in understanding what the mission was, laying out specifications and getting ready to do the program. The ensuing years have been the years in which the facilities have been built, like the vertical assembly building at the Cape, and laboratory facilities—both government laboratories and industrial laboratories all over the country. These are the facilities needed to test the hardware on the ground so that we can have very high confidence when it goes to the launch pad that the equipment is going to work. The last three years have been devoted to designing the hardware, and this year, 1965, is primarily a year of heavy ground tests, the year of qualification of the hardware to get it ready for flight. The first flight of the command module, the service module, and the Saturn I-B will be less than a year from now, sometime early in 1966. About a year later the LEM will join the pack and we'll have the entire spacecraft manned, flying in earth orbit in 1967. Again in 1967, the Saturn V, that massive vehicle, will start to fly. And, hopefully by early in 1968, the entire stack will be in the process of being tested in earth orbit in a series of missions, each of which is basically a complete rehearsal for the lunar operation.

Now many people say, "When are you going to get to the moon?" The problem is that we can't precisely say when it will be because we can't precisely predict how successful we're going to be in solving every developmental problem that we're liable to have on the ground. You probably recognize that the space age has matured considerably. Ten years ago, when the ballistic missile program was started in this country, it was almost a national joke (but not very funny to the guys working on the program) to kid about the number of failures that used to occur in the missiles at the Cape; and I can remember people saying, "Well, we took this one out in the back yard and blew it up instead of taking it all the way to the Cape and we advanced the program that way."

What actually was happening there was that the country was learning how to run developmental programs requiring tremendously high reliabilities in tremendously difficult environments. And, fortunately, I think we've learned. When we first started the lunar program, estimates were made based on how long it had taken things to mature in the ballistic missile program. Estimates were made on how many shots of the Saturn V would be required before there could be sufficient confidence to man-rate it—defining confidence here as about 90 per cent probability that everything would be all right—and the number that came out of the computers was forty. You'd have to launch that big rocket forty times and suffer probably 25 or 30 failures before you'd have enough confidence to put a man on top of it. That was obviously an impossibility as far as both time and expense and national trauma were concerned. The initial estimates were that it could probably be done with ten, and initial plans were set up on that basis. But we've had a lot of experience since then—experience with the Mercury program in which there were six completely successful manned missions out of six, and experience in the Gemini missions where we've had three successful missions out of three, culminating with the Gemini III mission of Gus Grissom and John Young within the last few weeks.

In the launch vehicle area, with Saturn I, which is by far the most complicated vehicle that this country has ever flown, all eight launches, and these are the first eight launches, have been completely successful. What this means is that we really do have a demonstration now of the fact that we can write the right kind of specifications, that we can build the right kind of test facilities, that we can get the right kind of discipline into the program so that the problems can be solved on the ground. I would be fooling you to say that we design things so well the first time that they are always right; nobody, unfortunately, is that perfect. But we are in a position to test the designs on the ground in such a way that we can determine before we ever commit them to flight; in fact many times before building the complex things that a spacecraft represents, we can determine that indeed the hardware is going to operate properly. I also don't mean to imply that we'll never have a failure in the space program, that we can do the job absolutely perfectly. But it is true that we will be able to cut down significantly the rate of failures from those expected four and five years ago. Nonetheless, the uncertainties on when we get to the moon are literally the uncertainties of whether we can, with two complete missions in earth orbit, work out all the bugs, or whether we will require three, four, five, or six; it is on that order of magnitude of uncertainty. We are able to fly these missions once in three to four months, and so the fact of going from two missions to seven or eight gives you some feeling of how difficult it is to pinpoint the actual touchdown date. The fact that some of these operations will take place in the early part of 1968 leads most of us who work on the program to believe that indeed there is a most significant probability that this mission will be completed in this decade. Increasingly over the next two years you will see the results of this heavy investment in ground tests showing up on the report card of manned orbital flight. Gemini will have several missions yet this year; Apollo starts to fly next year. And increasingly, the accomplishments that are today very real in this program will become apparent to large numbers of people.

To summarize, we believe the program is accomplishing the goal of developing a preëminent national space capability. The reasons the country wants and needs such a capability are sometimes difficult to completely state. To my mind, they add up to a conviction that space is going to be important. The country for the first time, in the last five years or so, has been in the position to extend the sphere of man's operation into a completely new environment. Historically we have seen that each time we have developed a new technology, have been able to operate in a new environment, such developments have led to tremendously significant improvements in our national way of doing things. In the space business in particular, space first started as a prestige battle with the Russians. I think there is still some evidence of the fact that the Russians use their space programs very heavily for propaganda purposes, but we would not be doing the space program today if it were only for a propagandistic competition with the Russians.

There are also tremendous potentials in space, unfortunately, for military as well as for peaceful purposes. We must be able to operate in space to guard ourselves against the fact that the arms race might escalate into space. We must know how to operate, frankly, without prejudging whether or not there will be war waged in space, and the NASA program is indeed the way to gather the skills that the country needs without bringing weapons *per se* into orbit.

In addition, space is already beginning to have significant impact on the civilian economy. Obvious benefits are weather satellites—those of you who read about the recent tornados can intuitively understand how the weather satellites and their increased use and capability will put us in a better position to predict and anticipate this type of thing, and put us ultimately in a position perhaps to control the weather. Similarly, communications satellites will open up tremendous new areas of communications and learning for vast areas of the world. Space is obviously a scientific gold mine. But, again, you wouldn't make the kind of investment we are making today for science alone. You'd go at a much slower pace if you were doing it for scientific purposes only. Lastly, there is an obvious interest which the space program generates in education, particularly on the part of the young. The fact that astronauts are maybe more glamorous, more wholesome than the Beatles indeed has a significant effect on the appeal of the technological type of education that goes on in the country. I don't mean to indicate that everybody ought to be a technologist, an engineer, or a scientist, but it is increasingly true that all elements of the society must understand things technological better, by and large, than they do at the present time. The Congress is ultimately the organization that has to appropriate the money for these things. General raising of the technological understanding of the country, which I think is coming about in the schools today, will obviously put everybody who has to make decisions in the future in a better position to understand the wherewithal, the reasoning and the rationale behind such decisions; so there are at least five and probably several more reasons why the program is going on. They all, to my mind, sum up to one thing: an intellectual conviction on the part of the country that space is important. It is hard for the country to maintain an intellectual conviction for a decade, and we have occasionally had some argument about how much money should be spent and whether the program should continue to get support. My impression is that we are somewhat over that hump, at least for the present time. The program is very solidly on the way. Our schedule forecasts are today the same as in 1961 when the program started; our budgetary forecast, somewhat under $20 billion to do the program, is today the same as in 1961; and with continued support, I might be able to come back to AIAA in 1970 and report to you on how we did get to the moon, not how we are going to get there.

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Curriculum—Innovations and Issues, 1965

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EDUCATION is the instrument by which a society creates its future. Not only does it induct the young into the culture but it provides the means for the modification of the society in a desired direction. If we achieve the Great Society, it will be through the use of the system of public education.

Any group of educators concerned with improving the curriculum of the schools obtains an indication of the type of change that is needed by an analysis of the problems and goals of the society. Five current concerns are: (1) the explosion of knowledge, (2) cultural disadvantage, (3) mental health, (4) automation, and (5) lack of commitment.

The Explosion of Knowledge

The present expansion of knowledge is unparalleled in the history of mankind. Ninety percent of all the scientists that have ever lived are working today. Each day they produce research papers that if published would fill six sets of Encyclopedia Britannica. In the fifty years between 1900 and 1950, man accumulated as many new facts as he had discovered in all previous history. By 1960 the number of facts available in 1950 had doubled. At its present pace, knowledge is being doubled each seven years. If the acceleration continues, there will be 2,000 times as much information available in the year 1999 as at present.

Educators confronted by this vast increase in knowledge find themselves forced to make new approaches to determining what should be taught in the schools. Coverage of all the available knowledge is no longer possible—if it ever was. Some basis of selection must be discovered. The multiplying of knowledge means that a person informed at present will be out of date five years later unless he remains a student. Some approach to helping people develop the skill to continue to educate themselves must be sought.

One proposal has been to make a "structure of the discipline" approach. Scholars in the field are brought together to describe the basic concepts and generalizations of the field and the method by which new knowledge is sought. Their conclusions are organized into a course which gives a student the basic elements of the structure of that discipline, and skill in seeking new knowledge. The B.S.C.S. (Biological Sciences Curriculum Study) program is a good example of this approach.

The persons who have developed B.S.C.S. say that by 1968 the content will be 30 percent obsolete and by 1975, 100 percent obsolete. If this is true, the schools must help each student develop a method by which he can continue to educate himself after he leaves school. Recognition of this need has caused the people developing the B.S.C.S. to stress skill in inquiry.

Suchman has developed a technique for giving inquiry training at the elementary level. It is a procedure by which students examine data, make inferences, and finally arrive at the concept the teacher hoped they would. The procedure is called "concept attainment."

Some people feel that an even more important learning activity is the development of skill in concept formation. Since current concepts and generalizations will need to be modified in light of new data, the student should go beyond developing skill in attaining concepts that have already been formed. He should have experience in forming and testing new generalizations. Crutchfield, Torrance, Getzels, and Jackson, to mention a few, have been seeking to discover indices to this type of creativity and teaching procedures which further it.

A consideration that has not received as much attention as it should, in my opinion, is that the structure of knowledge possessed by an individual is a personal thing. Each person perceives uniquely; he selects the factors of his environment with which he will interact and he interprets the stimuli that he selects in terms of his needs, purposes, and background of experiences. He forms his own organization of knowledge built around the basic motivations of his life. Each change, each fact learned, is only a modification of the existing structure.

What has been the impact of this knowledge explosion on the field of industrial arts? Is knowledge in the field increasing? Are you engaging in major curriculum studies to determine the deletions, additions, and modifications that should be made? Have you developed skills of inquiry that will enable students to continue to increase and effectively organize their knowledge?

Have you faced the future of your field amid the accelerating expansion of knowledge, unless you face these questions realistically?

The Culturally Disadvantaged

Within the past few years, Americans have become acutely aware of wasted human resources. Many have come to recognize that a large portion of the population has been denied the opportunity to develop their potential because of the lack of intellectual stimuli in their environment. Through lack of educational opportunity and the economical resources to secure cultural advantages and lowered visions of possibilities due to discrimination, a large portion of our population *has* failed to secure the education needed to develop the competency to compete effectively in the present world.

The great emphasis in education the past decades has been the education of the gifted. Curricula in the high schools have been primarily orientated to those that are college bound. Colleges and universities themselves represent tremendous expenditures in the education of the gifted.

The nation has recognized the necessity for attempting to break the futility cycle of the disadvantaged. Many have come to believe that poverty has caused lack of educational opportunity which in turn fosters continued poverty and lack of educational opportunity.

During the past year, the national government has taken firm steps to provide better education for the culturally disadvantaged through operation "Head Start." Children from disadvantaged homes are being given preschool experiences which will make it more likely that they will succeed in school. Through the Education Act of 1965, Federal monies are to be supplied to local districts in terms of the percentage of families of income below $2,000 a year. These actions are attempts to provide better education for the disadvantaged.

Some psychologists, Combs for example, assert that intelligence can be fostered. If disadvantaged children are provided with a more stimulating environment, they will become more intelligent. From my point of view, this simply means greater development of the individual's potential as the result of additional stimulation. Whatever the name applied, the function of the school is to develop intelligence of all rather than classify people in terms of their present intelligence status.

What is the role of industrial arts? Does it see a major contribution it can make in the education of the culturally disadvantaged? Will there be a continuation of the effort to avoid being used as a "dumping grounds" or will this need be seen as a significant opportunity?

Mental Health

Of major concern to many statesmen and educators is the problem of mental health. Many children lack a sense of a role in the society and a feeling of belonging.

The mobility rate is high. In 1957, one out of eight school children moved at least across the county line and the numbers who move continue to increase. Many of them lose roots that have tied them to a family and a community and the security that comes from such identification. If the children who move belong to a close-knit family in which there was love and support, the transition is not too difficult. If they belong to broken homes without much love, the impact is serious.

As a result of discrimination and lack of opportunity, the self concept of many youngsters has become damaged. They do not see themselves as worthy, wanted, or adequate. Still other youngsters have become alienated from their society. They feel rejected and unwanted and as a result, detach themselves from the goals and norms of the society. In severe cases, they rebel and attack.

As communities have grown larger, they have become more impersonal. More and more youngsters have become anonymous and lost a sense of identity with the community around them.

One out of ten Americans spent some time in an institution securing treatment for mental or emotional disorders.

The concern for the mental health of school children has become so great that the national government is supporting programs to prepare teachers of the emotionally disturbed. Experiments are being conducted with counselors in the elementary schools.

Fundamentally, however, it has become necessary for educators to reexamine their understanding of motivation. The importance of an adequate self concept and of the student having a vision of possibilities of achievement in his society must be recognized as basic motivations. Unless teachers can promote the development of these two aspects of motivation, any attempt to stimulate interest in a class activity will seem trite and superficial to many students.

What is the function of the industrial arts teacher in the field of mental health? The opportunity exists for informal personal interaction and for assisting pupils to gain new visions of himself, his role, and his potential.

Automation

One of the most important problems the nation and its educators face is automation. It is especially important for your field. Economists in the government tell us that three-fourths of the workers in 1975 will be employed on products that are not yet invented. What type of occupational education and training is needed? Another government source states that each high school graduate today will change trades at least twice during his work life. It will not be possible to prepare a person in one vocation that he will follow all of his life.

The most startling statistic given out concerning automation is the prediction that by 1975, 20 percent of the people who want to work will be unable to find a job. The unskilled and the most disadvantaged will be the ones for whom there will be no opportunity to work. At the present time, only 6 per cent of the jobs can be filled by unskilled manual labor. How do you help a person who cannot find work feel a sense of worth and adequacy or develop a fundamental belief in a society which has no use for him? On the other side of the coin, how do you help those people who are working and supporting the others to continue to believe in the worth of all human beings? To believe that human beings are more important than a machine?

It is no longer satisfactory to conduct a program of education that develops the potential of only a portion of the population. What is the role of industrial arts in facing a future which requires emphasis on development of all and continuous vocational re-education of all?

Commitment

In an article in LOOK Magazine entitled "The Age of Payola," Samuel Grafton reported a survey of 300 youths from all parts of the country. He concluded by saying that the prevailing belief seemed to be that anything was all right as long as you can get by with it and it doesn't hurt anyone. Dan Dodson completed his study of suburban youth with the conclusion that they are "calm, cool and uncommitted," and refused to take a stand for anything which might interfere with their upward mobility.

Many adults are concerned about the juvenile delinquency rate and the apparent indifference of a large portion of the youth. Others are gratified to see so many youth become active in the civil rights movement and other endeavors to improve society. Few would deny that the problem is a critical one for the society and its educators. What can be done to help an individual decide which values are important to him and develop the commitment to live by them but with the flexibility necessary to allow him to revise them in light of new data?

In a shrinking world in which there is instantaneous communication and increasing travel and mobility, the individual will be increasingly confronted with the necessity of knowing what he believes if he is to have an identity and know how to live and work with people who hold different beliefs. But, if he has accepted a pattern of values simply by conforming to those around him, he will be the social cripple. He will not know how to deal with the conflict in values that he will face within himself, in his own society, and among cultures.

How is it possible to develop people who have commitment enough to guide their lives but at the same time are able to continuously revise beliefs in light of new data? The best research that I have been able to discover is that commitment is effected through contact with people who are committed and who are concerned with the welfare of the person involved. If teachers are to affect the values of youngsters, they will need to be personally concerned about the student and stand for something themselves.

Efforts to Modify the Curriculum

In this society, education faces a tremendous task. For the first time, the entire nation from the President on down recognizes the significant role of the school in changing the culture. Whether the problem is international relations, mental health, poverty, civil rights, or divorce, education is being asked to be a part of the solution. More people are demanding more things of the schools now than ever.

As a result of the increased demands, many are impatient with the slow evolution of the school curriculum. The pragmatic procedure that has been followed, in which individual schools and teachers have been expected to evolve a better curriculum, is no longer satisfactory in the eyes of many. Many serious attempts are being made to bring about change in the school curriculum by an approach directed from outside the schools. Foundations, universities, and the government all seek to bring about change in the school curriculum.

At least thirty major curriculum projects, financed and in operation, are open attempts to effect curriculum change throughout the nation. The procedure is typically for someone to decide what the change should be, to develop a system for providing the instruction desired, to field-test it in enough situations to eliminate the weaknesses, to secure administrative decisions at the local systems that change should be made, to inaugurate experimental programs with administrative support, to provide in-service education programs to develop the skills to carry out the new programs, and to diffuse the innovations throughout the local systems.

Regardless of the questions that may be asked concerning the justification of persons operating foundation funds being able to make these curricular decisions, the process is being followed. With an ever-increasing amount of money being appropriated by the federal government for education, the power of federal government in determining curricular modifications will increase. If the public schools do not carry out the kind of education the federal government deems desirable, other agencies will be established and supported to do so. We already see activities of this kind through the Equal Opportunities Act.

The Choice

Where does industrial arts fit into the entire curriculum picture? What is your role now? What will it be ten years from now?

Here are some questions I think you have to ask yourself. Who are you? What is your function? What is your contribution in the curriculum? Is your role to interpret the industrial life of the nation to students? How does this differ from what is being done in economics and sociology? Is it your role to interpret the processes of industrial technology? If so, how do you make sure that youngsters are not more advanced than teachers? What are you really doing with automation and the difference that it is making in industrial life? Is your role to provide means for the expression of creativity? If it is, what does acceptance of this role mean for the following of patterns and the expectation that students will execute pre-developed projects? Is your role to provide occupational education? It so, what type? Is your role improvement of mental health and the development of commitment? If so, what are the activities that you carry on that make this contribution?

Whom are the teachers of industrial arts serving? Do you see industrial arts as the general education for all students? Do you see it as an important part of the curriculum of the college bound? If so, you haven't made your case because most high schools are eliminating industrial arts from the curriculum of the college bound. Do you see yourself serving primarily the group that is not college bound and not taking a specific occupational training program? What is your audience? Where do you take your stand? What are the kinds of pupil growth that you are committed to produce? What evidence do you have that you can do so? What position do you take in the curriculum discussions in a school faculty? Do you want to go it alone? Do you want to be a part of a team? Do you want to be classified as vocational or general?

In the play, *The Devil's Disciple,* George Bernard Shaw says that the major crime is not rape or murder or robbery. The major crime is indifference which enables the enemy to breach the wall and ravish the city. Are you indifferent to the issues that I have been raising and to the problems of our society that I have been describing? If you are, and are also indifferent to others that I have not mentioned, industrial arts will soon be eliminated from the curriculum of most schools. You must see yourself as a part of an effective social instrument or be discarded as an unnecessary appendage. The choice is yours.

Opportunities for Individual Development Through Programed Instruction

W. C. MEIERHENRY, *Assistant Dean, Teachers College, University of Nebraska, Lincoln, Nebraska*

MY topic is improved individual performance through programed instruction. I shall interpret the topic to include two kinds of improved performance—first, on the part of the student; and second, improved performance on the part of the teacher. It is necessary, perhaps, to develop some background on what programed instruction is all about.

First of all, programed instruction incorporates a number of techniques and psychological principles that have been known for some time; but it combines them in a unique fashion never before done in instruction. Programed instruction requires the specification of behavioral change on the part of the student. This is the fundamental principle so that one starts with clearly defined objectives in behavioral performance form.

Second, the content which is to be presented to the learner is broken down into small bits called steps. The steps in turn are presented to the learner, and in the earlier days of programed instruction he was expected to respond to each of these steps or bits by a written response. The programed instruction device, whether it was a programed text or a machine, then verified the correctness of this response and hopefully reinforced his responses. The learner then moved on to the next bit of information or frame.

Feedback is an essential ingredient in programed instruction. The feedback thus obtained has value to the learner in terms of identifying whether his response is right or wrong; it also has value to the person developing the program to give him some insight as to whether or not the presentation of the subject matter—the developing of the frames—was appropriate or needed to be changed or adapted.

Studies with various kinds of teaching machines have indicated that the machine, at least at the present point of sophistication, is not essential for the orderly development of programed instruction. In fact, because of mechanical breakdown, other kinds of failures and problems, individuals pursuing programed instruction via machine often took a longer period of time than if it were in some other form such as a programed text.

As a consequence, the most likely form for material today is in a programed text form. The programed text can be of two kinds. It can be a scrambled book in which the various stimulus frames are found scattered throughout the text and the learner is required to go back and forth among the pages as identified to find the correct response. The other type of programed text is one where the learner goes down a page of material, pushing a plastic guide or some similar material which covers the remainder of the page and, after going through one set of pages on one side of the book, then reverses the process and moves from the back to the front of the book.

The point of all of this is that the most important thing in programed instruction is the program, and not the kind of mechancial means by which it might be displayed.

There are two distinct types of programing. The first, called a linear program, was popularized by Skinner and many others. In the linear type of programing, the programer develops bits of information in such a fashion that one bit or sequence builds upon the preceding item of information. As the learner goes through the programed materials, hopefully each bit of information will be at a level and presented with such clarity that he will be able to pursue the item with almost a hundred per cent success. In linear programing the fewer frames the subject is unable to respond to correctly, the better the program is presumed to be.

The so-called branching technique was popularized by Crowder, who believed that learners with different backgrounds, with different levels of motivation, with different understandings of the subject matter, ought to be given certain options, certain opportunities, to indicate whether or not content was known to them; and, if it was, they could by-pass a loop or series of frames. If, on the other hand, the subject's response to a multiple-choice question indicated that he did not know the material, he would be required to complete additional frames, in some ways considered to be a remedial loop, before he could proceed. In other words, Crowder felt that the subject's response should determine the way in which he should approach the subject matter and whether or not he should be expected to do "all of the program or only those parts which seem pertinent and necessary for him."

Let us then look at the matter of increased student growth through programed instruction. In the earlier days of programed instruction, it was thought that an entire course could be programed—that is to say that you might program an entire semester's work in mechanical drawing, or woodworking, or history, or some other subject area—and that you might put the student into that course and permit him to work his way through the material.

It is interesting that the early development of programed instruction made some of the mistakes which had earlier been made in the field of television, and to some degree in the field of motion pictures. A look backward at some other technological developments would have disclosed that the difficulty of developing an entire course would be so great that it ought not be attempted. It was attempted, nevertheless, and eventually there may be the development of entire courses for a semester, or a year, or perhaps even several years in length so that the student may continue through an entire series of experiences which are necessary for the mastery of a large area of subject matter.

At the present time, however, the development seems to be in the way of shorter programs which pick up a particular set of ideas, a particular set of skills related to a certain topic. For example, programed instruction might be used to teach the necessary skills and understandings to become proficient in the use of the slide rule. Discrete bodies of content which do not have to be taught at any one point are amenable to programing. Content can thus be individualized and learners placed in programs in such a way that they do not disrupt the other students. Another such example is the development of a vocabulary which is necessary to understand a certain area, or the development of certain skills which are necessary for the learner to make progress. The present trend, therefore, is in the direction of parts of courses rather than an entire semester of them, or a year's course.

Somewhat along the same line is the use of programed instruction for remedial work or for acceleration. If programed instruction were available, it would not be necessary for the instructor to take the time to do the re-teaching or review which is necessary for the student to proceed. The student may need additional help because he is somewhat slower to comprehend, or has missed class for illness or for some other reason, and remedial attention is necessary. The other side of the coin, of course, is that of acceleration, where students are so advanced that it does not make good sense to hold them back to the pace of the rest of the group. In those instances one might either permit the student to accelerate in terms of time, or he might be permitted to enrich by being given subject matter with which the other students may not be ready or able to cope.

With the tremendous increase in the number of areas of specialization that are confronting formal education institutions, another possible advantage of programed instruction is to provide some of the experiences for which the instructor may not have the appropriate information or skill. Again, in such instances, programed instruction might be a means by which the school could provide individual learning opportunities by providing those individual courses of instruction which might be developed commercially and which would make it possible to meet an individual need otherwise not possible within the regular school program.

The most significant contribution is the degree to which programed instruction requires the teacher to re-orient his teaching in terms of student needs. As one becomes concerned about meeting student needs, it becomes evident that one must have clear objectives in mind, and these objectives must be stated in behavioral terms. The fine, general kinds of objectives used often in our lesson plans may be satisfying to us, but they do not sufficiently identify what it is that the student must do differently *after* the instructional sequence. Another source of individual teacher growth is in the analysis of the instructional procedures themselves. In the development of frames of bits of information, it is necessary to give particular attention to scope and sequence, and systematically work through the content to be communicated in an orderly manner, according to a learning scheme.

Of all of the advantages of programed instruction, probably the most significant is feedback and the accompanying possibility for tryout and improvement in the instructional sequence. One of the difficulties with so-called conventional teaching for research purposes has been the problem of duplicating or replicating what has occurred. In the case of programed instruction it is possible to have a record of student response, student errors, the degree of mastery of material, so that it exercises a dimension of control over the learner.

Where can one obtain the material which might be useful in the field of occupational education? This is still a difficulty all across the field of education because, as you can understand, the amount of time and effort required to develop programed instruction is such that it has been possible to program only a few areas. The teacher therefore has the question as to whether, first of all, materials are available in the areas in which he would like to use them; and second, if they are, are they of sufficient quality that he would like to use them; or is it going to be necessary for the teacher himself to develop his own material. Because of the time and effort required to write good programs, it is evident that if good materials were available in the area in which you wish to use them, it would certainly be much better to "take them off the shelf."

On the other hand, if we are to make progress in the development of materials for all parts of the curriculum, it certainly will be necessary for a much larger number of people to actually become involved in the programing process itself. There are workshops and institutes in which one can become acquainted with the skills and understandings involved in good program writing, in good frame development, and in the validation and tryout of the programs. Committees have also been at work in the area of developing criteria which can be applied to existing programs.

In concluding, I should like to argue for the development of what has come to be called an instructional system. To some degree programed instruction is also an instructional system, but because so much programed instruction has become associated only with printed and verbal materials, the area of instructional systems has a broader connotation.

An instructional system is conceived to be the appropriate interrelationships of man and hardware and the environment. Instructional systems not only develop verbal materials but also go into other kinds of teaching resources. This would certainly be necessary in the area of vocational and technical education. For example, if the area to be developed is a skill area, it will be necessary to use something beyond verbal materials. You may talk about swimming on dry land, but you are not going to get very far in swimming until there is a pool available.

In much the same way, in the development of scope and sequence of content, you must also give attention to the total environment, including the functional and realistic experiences necessary to meet the objectives. At one point it may be necessary to use an 8-mm cartridge load film to develop an understanding, or to help the learner to perceive the kind of skill which should be mastered. At another point it may be a mock-up. At some other point you may want to use a simulated experience. The system, in turn, interrelates the hardware, the technology, in such a way that as the student works through, the behavioral objectives are specified, the scope and sequence are worked out, but within a somewhat broader context in terms of the stimulus materials and a broader range for response than the mere pencil-and-paper responses which we often consider in connection with programed instruction.

And After the Revolution?

JAMES W. BECKER, *Director of Research, Pittsburgh Board of Public Education, Pittsburgh, Pennsylvania*

ALFRED Cobban, in his wonderful book, *In Search of Humanity,* states that "Each age has many problems, but among them one or another seems in turn to take precedence and to present the major threat to society, or to civilized life, if it is not eliminated. In fact—and this is encouraging—such problems seldom are solved: most often they are transmuted by time, fade into the general mass of difficulties that beset every generation, and under the influence of some obsessive new threat are seen to be no longer as fundamental as was once thought."

We tend to develop "firemen" in our present way of living, firemen who are trained to put out the many brush fires that erupt into flame. These same fires remain smothered only to blaze again when least wanted or least expected. The history of education is charred with the short memories of the innovator, name-seeker, and charlatan who ignore the past with a promise for the new present and future. But panaceas do not work.

No period of time—no epoch—no epic—is void of a many-sided complexity. The skeptic rides with the radical, as does the liberal, conservative, and reactionary. From this leavened dough comes forth a new generation bearing the same offspring, many times under a new name.

No one can deny that we are in the midst of a revolution, one so severe that its immediate consequence is being felt by all. Perhaps it would be wise to set a stage, to arrange some of the components on this stage, and to provide a brief analysis of some of the leading forces which combine to make for the greatest revolution mankind has ever witnessed.

New technology has increased the varieties of job available. However, jobs are becoming more demanding in terms of the skills a man must have. The average worker can expect to have at least three major job shifts over a thirty-five year span. How can we help man to plan ahead?

Automation is another part of the revolution and is a direct outcome of technology. The United States is able to out-produce all countries in the world in any area of production. A classic example is our ability to provide more food on less land. Yet people are hungry.

Automation has created a number of social problems which will have to be considered; chief among these is the concept of boredom. As man becomes less and less involved in his work and works with smaller parts of the total job, he will become bored. Jobs that demand little in the way of thinking will demand little from the worker in terms of responsibility. As the problem accelerates, the worker will lose more and more of his individuality and will be in danger of becoming simply a part of the machinery which he handles.

The population in America will probably reach 260 million people by 1980. Within this population growth, we will begin to get a major number of people over 65 years of age and a larger number of people under 20 years of age. The rural population will continue to shrink until we will probably have fewer than 50 million people living in this type of setting. Conversely, the urban population will represent about 70 percent of the total population in America. America's population will be highly mobile. It has been predicted that within a five-year spread at least one-third of the total population will have moved at least once. Our population will continue to spawn more poverty in an already effluent society. Somehow, people born in poverty tend to produce more children than other groups.

One could go on developing an extensive list of issues and never arrive at the potential for human growth and development. My listing is merely to illustrate the tremendous lack of understanding man has when he considers the social problems we are presently generating. While these are slightly exaggerated, they do help to illustrate the urgency of our needs. Is it not incredible that we have such profound knowledge about scientific and mathematical discoveries, but lack the ability to cope with the social problems created by these discoveries.

If you are to understand desirable human growth and development, you must be able to understand yourself. "Who am I?" is still a worthy question.

My family, for many generations, had been noted for their abilities in cabinet-making. Imagine my surprise when taking a course in *manual arts.* I spent the first semester in squaring a piece of wood; as the large piece became smaller and smaller, my outlook for the industrial arts teacher also shrunk in size. Somehow during that semester I did manage to salvage a cumbersome-looking necktie rack, designed to look like a maple leaf with space for three neckties. Nowhere in my exposure to the several years of the program did anybody teach the industrial processes of man. Somehow this was left to chance. How many of your programs are still antiquated and planned for chance?

Carlyle once said, "Today is not yesterday. We ourselves change. How then can our works and thoughts, if they are always to be the fittest, continue the same? Change, indeed, is painful, yet ever needful and if memory have its force and worth, so also has hope."

Your first job is to change. But change for the sake of change will surely lead to chaos. In a deliberate way you must decide what needs to be changed.

Let's take a look at you. What kind of person are you? What are your skills and competencies? Are you proud to be in industrial arts? The history of industrial arts is quite rich in accomplishments. Are you going forward instead of clinging to the past?

During eight years of college teaching I had many industrial arts majors in my courses. All these students had one thing in common—they were apologetic. Too much of their time and energy was directed toward defending their honor and position. Anyone who spends the majority of his time defending who he is, what he does, and why he does it will never develop the offense necessary for the challenges in today's changing world. The industrial artist has nothing of which to be ashamed. Stop apologizing for your existence. Change! If you resist change and try to keep within a mold, you will surely die.

Many of my students knew quite well what they were not—they were not vocational educators; they were not technical educators; they were not art educators. But what were they? It is much easier to say what you are *not* than it is to say what you are.

Why waste your time and effort arguing with art educators? Each field represents a unique discipline; each has a contribution to make. Art educators do not have all of the answers concerning child development, although when you read some of their literature, you might be led to believe that they do.

Recognize one common fact. We do not know the content youngsters are capable of learning. That is to say, we do have a lot of data based on observations; unfortunately these observations are too often limited to a status quo condition. What youngsters could learn under certain controlled instructional programs still remains unknown. If Bruner is right in assuming that a child can be taught anything at any time in an intellectually honest way, the door is thrown open for all kinds of experimentation.

Your first order of business should be to examine all of the research in the field of industrial arts. Perhaps this would be a good project for the yearbook staff. Classify the research into the necessary categories of instruction, content, methodology, supervision, philosophy, objectives and the like. Each study should be examined to determine if the research was conducted with the proper research tools. If the study does not measure up to good research techniques, disqualify it immediately. Such a treatment will enable you to study the past, derive the known truths about your field, and enable you to plan new research ventures.

The association should be in a position to conduct some extensive research studies. Too many of your research projects are limited to the laboratory method versus the self-discovery method. These studies have proved little in the past. An additional burden has been the "one shot" master's and doctoral studies. Get organized to replicate the best of your research. Do not rely on the academic exercise of a dissertation to prove your worth.

While the major job of synthesizing, analyzing, and evaluating your previous research is being conducted, a committee should be at work digesting the varieties of philosophies existing in your field. What are your major objectives? For what purpose does industrial arts exist? These are the key questions that will need to be answered. You cannot provide adequate answers without examining the national and world scene. What contributions can you make? What is to be your role?

Remember that we are living in a revolutionary period. What happens to the leaders of a revolution? Normally the revolution feeds on its leaders. This need not happen if you plan ahead.

Too often much of the research in education has been the bandwagon variety. It is popular to do research in an area with a "catchy" name—creativity, problem solving, self-discovery, thinking skills—but what does all of the evidence prove?

A third area, one in which a major portion of time will have to be spent, should concentrate on the subject of your discipline. The solid academic disciplines are and have been with us for many years. Quotations extracted from Aristotle to prove that industrial arts existed in the days of the early Greeks will do nothing to amplify your cause. You represent a derived discipline.

One of the most exciting ventures today is to develop new disciplines. Many of your fights with other disciplines center around the argument of encroachment. Art educators have accused you of invading their discipline. This is healthy.

Do you remember the Russian intelligentsia? After the revolution in Russia the people were able to survive because of this group. Here we had a classical example of an educated group of citizenry. To wear the label *intelligentsia* was a high honor; to qualify meant that the person so designated had a breadth of mastery in all academic fields. Only those persons who had the widest breadth were so nominated.

Industrial arts is a derived discipline. This very thought implies a special type of scholar, one who is capable of mastering many fields. The industrial arts scholar must feel completely at home with the skills of research as well as the tools of selected academic disciplines. It is no easy job to abstract knowledge.

The history of technology cannot be divorced from the political scene any more than the fine arts can be separated from philosophy. Each makes a contribution.

In a derived discipline you will have to be on the alert to change. New approaches will have to be developed as new knowledge is discovered. You will be in a constant state of flux, thus demanding flexibility and adaptability. This calls for top scholarship within a climate of change.

If you accept my position about a derived discipline, it is imperative that you rethink the structure of teacher education. Examining your research, your objectives, and your philosophy is only a beginning point. From these findings you can build a new program for prospective teachers.

Your college students can be selected on the basis of certain competencies and skills. Too often in the past students have been selected and programs developed for the students. The result has been a watered-down program for watered-down students.

The question—And After the Revolution?—is being decided today. Theory, as advocated by the college professor, seldom achieves the actual practice of the public schools. Professors and students are poles apart in their interpretations of industrial arts.

The most pressing problem confronting the industrial arts teacher is one of survival. The total concept of occupational, vocational, and technical education has received new emphasis on a national scale. What can the industrial arts program contribute? If the industrial arts are to be truly general education, how can they best be taught?

The industrial artist is in a unique position to provide bold leadership in the OVT movement. Failure to assume the role of leader could spell disaster. How are you preparing?

Symposium—Increased Individual Responsibility and Commitment Are Needed in Industrial Arts

How Are Individual Learners' Potentials Discovered?

GLENN S. DUNCAN, *Professor of Industrial Arts, Chico State College, Chico, California*

How does one discover the individual learner's potentials? What makes the resolving of this question difficult is a long list of considerations which must be recognized by us if we are to judge: Desirable habits, traits, and attitudes; desirable capabilities, specific talents; individual differences, interests (prevailing and to be developed); economic factors; maturity level of students; intelligence requirements and innate abilities; facilities at hand to provide experiences; validity and reliability of our efforts to diagnose; and recognition that nothing is absolute.

All of these considerations and many more must rest on the assumption that we as teachers have the knowledge, background of training, experience and insight—the competencies to make judgments on the learners. Since none of us is infallable, I must proceed with humility in regard to this assumption. If the space age has taught us anything, it is that there are many human potentials that we have been slow to recognize. Do we, and can we, know all the strengths and potentials of our students?

My understanding of the school's job (and our job as a part of the school) is conditioned by a point of basic philosophy: We are what we are because of our innate endowment, plus the effects of experiences in our environment.

Dr. John Dewey's experience curriculum recognized that every experience has its impact of change on the individual, and selected experiences such as we include in our programs in industrial arts can lead to discovery and development of students' potential. Time is not adequate to include all experiences, hence the broad, basic, fundamental subjects should be represented.

Industrial arts activities have a distinct and unique contribution that they can render in the discovery of a pupil's potential. These activities are concrete in nature and intriguing. They appeal to the natural urges to manipulate, to investigate, to construct, to create, to beautify, to imitate, to excel, and to possess.

Discovering human potential then becomes a process of subjecting the learner to many experiences, observing his reactions and evaluating the results.

Providing Experiences

Each subject provides its experiences peculiar to its discipline. Industrial arts does likewise by providing "opportunity for the study of man and industry through participation in typical experiences in industrial processes and techniques at the same time enriching other instructional fields such as mathematics, science, and language arts by bringing theory and practice closer together through illustrations and practical examples which are industrial in nature; and discovering and developing personal aptitudes, interests, abilities, self-reliance, good judgment, and resourcefulness through problem-solving and self-expression in an environment related to industry. Industrial arts education is designed to help prepare individuals to meet the requirement of today's culture."[1]

This implies good teacher preparation, good methods and techniques of instruction, good facilities, and all that goes with a good and wholesome learning experience. These experiences should be broad, basic, and general to acquaint the learner with many applications—later they may be channeled and specialized.

Evaluating the Learner

Assuming that the instruction has been carefully analyzed and presented, the learner's reactions must be carefully noted if a judgment on his potential is to be made. The instructor can ascertain to some degree the success of the pupil and his reactions as to whether the experiences have been *satisfying* ones to him. A sound procedure at this point is to use some achievement tests. As tests and records of performances in many subjects accrue, and as the results are noted and compared with other kinds of tests of a guidance nature—aptitude, attitude, etc.—the student's potential may become known. Tests at best are only an indication of performance in a particular subject, at a particular time and place. An accumulation of such data over a long period of time, coupled with a knowledge of the student's attitude, work habits, and general demeanor are strong indicators of potential.

Having the potential identified does not necessarily assure the learner of placement where he can use this competency. The *will to do* and *chance* still play a very important part in one's life; however, these factors may be conditioned on the basis of one's potential.

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[1] California Industrial Arts Curriculum Committee, *Guide for Industrial Arts Education in California* (Sacramento: California State Department of Education, 1958), p. 3.

How Are the Individual Learners' Potentials Released?

D. L. JELDEN, *Assistant Professor of Industrial Arts, Colorado State College, Greeley, Colorado*

POTENTIAL has been defined as "that which can, but has not yet come into being--undeveloped, unrealized, latent." If this definition is accurate, and I believe that it is, the high point of any learning experience is the realization of some objective or experience. To me, the hardest part of any classroom experience is the bringing out from within each student the latent ability that he may have. Ability or potential for doing a certain thing cannot be given to a person. If I may quote from a book by Kahlil Gibran, entitled *The Prophet*, he says, " . . . no man can reveal to you aught but that which already lies half asleep in the dawning of your knowledge. The teacher who walks in the shadow of the temple among his followers gives not of his wisdom but rather of his faith and his lovingness. If he is indeed wise, he does not bid you enter the house of his wisdom but rather leads you to the threshold of *your own* mind. The astronomer may speak to you of his understanding of space, but he cannot give you his understanding . . . The musician may sing to you of the rhythm which is in all space, but he cannot give you the ear which arrests the rhythm nor the voice that echoes it. For the vision of one man lends not its wings to another man."

The key word for the release of an individual's potential is motivation. It is up to the teacher to motivate students to do the things for which they as students fail to see a need. Our responsibility is to arouse and ignite the spark of need for a particular area. Without some form of motivation, it becomes generally impossible for a person to achieve potential. This motivation may take many forms—emotion, impulse or desire, a longing to do. It is the spark that incites or impels one to act.

Let me give you an example of motivation in a classroom situation. I taught several years ago in the junior high school general shop program. On the first day of class, students came to the shop with wild anticipation, ready and eager to learn. They had poked their noses against the glass for seven years waiting to get into the shop. At last, they had finally arrived. On the table in front of me was an electric motor and a battery. Without saying anything, I plugged the wire into the battery holder and the motor began to turn. (For those of you who know, I had a 12-volt battery and a series AC-DC motor.) The crazy thing took off like a scalded dog and really made the kids look. My first statement to the class was, "Do you fellas want to make one of these and play with it?" The response was overwhelmingly "Yes." I had precut all the material and had it sorted in piles on the table. On purpose, I let them do what they wanted in the way of picking up the pieces on the table, telling them nothing. It wasn't long until most of them felt the need for some assistance in "How does this thing go together?" It was at this point that I related the importance of a plan and a plan of procedure. My objective was to create in the students the need for the orderly procedure of putting this motor together. At this point, the need was present, and the class was willing to learn and participate. I am not advocating that every student in the shop be left to his own devices, but I am pleading to you as industrial arts teachers to create within the student the need for the things you teach. Give your students a sell job. Convince them that they will have a use for this method, or point out where this technique will save them some money and/or time. *Motivate!*

If at this point we can agree that motivation is the key to learning or releasing the inner potential, let us look further at how specifically we can motivate with direction and purpose. It becomes necessary for the teacher to know his students. This involves more than mere name-calling, which in itself is important, but the teacher should make an effort to *know* each student. The schools have records for this purpose. Let's make more use of them.

The personal program of each student should have some sort of a family history and background. If it does not, one should be started. It should not hurt you as teachers to play psychologists and read between the lines of what the student does and says. Observe his parents. Talk with other teachers and see if they have any judgments that may give insight into the personality of the individual. Observe in class the social development and cooperative attitudes of your students. Look for some clue to solve this particular problem or channel that particular problem down a specific path. Find an area of interest or other possible achievements; success breeds success. Check for physical disabilities that you may have been unaware of at first glance—eye trouble, 'handedness' (right or left), etc., may affect greatly the actions of the student. Use words of encouragement and support the ego of the individual. Psychology should be a useful tool in the classroom.

In certain instances where problems arise, if you feel that you have tried all and are at your wit's end, you may want to call the student in and talk with him privately. You may want a case conference with some of the guidance and counseling personnel. You may be surprised to know that you are at fault, not the student. As simple a thing as a schedule change could solve the whole problem. I have the feeling that we as teachers think we know more about our students than we really do. Another characteristic that is common to man, regardless of station in life, is pre-judgment. As individuals, we make judgments of those we meet and if those judgments turn out to be a little wrong, we subconsciously feel that we are deflating our egos to admit we were wrong. With this on our minds, we create false relationships with our students.

If we as teachers are to grow in our profession, and grow we must or die (an old Chinese proverb says, " . . . not to progress is to fall behind"), then I sincerely believe that we should not be afraid to try new things. Give a new method or technique a chance. Change your inspection. Throw away some of the old ideas and explore the new. You will be a better teacher, and the learning potentials of the students under your supervision will be developed or released more because of it.

Symposium—Social Barriers to the Release of Human Potential

Barriers of Segregation and Restrictions of Freedom

EDWIN C. HINCKLEY, *Associate Professor of Industrial Education, Brigham Young University, Provo, Utah*

WEBSTER uses as synonyms for segregation, set apart, separate, select. The selection resulting in segregation has many bases. Individually, you have homes in an area segregated from others by income. You have religious leanings in a particular direction that segregate you from all other religious groups.

What is there about segregation that makes it such an emotion-packed word? I think the answer, in a word, is abuse. Eating is a necessary and pleasant activity, so is work. But, over-indulgence or abuse of either activity results in harm to the body. Abuse of the principal of segregation is resulting in harm to our country. Natural segregation is based on interests, income, geography, religion, education, national background, or any number of other factors. The things that seem to be giving us fits at the moment are income, education, and skin color.

When I first saw the title on which I have been asked to talk today, it was with a certain amount of anxiety because, frankly, it didn't seem to have much relationship to my life. By background I am Anglo-Saxon, middle-class, adequately educated, a product primarily of the western states. As I reflected, I was not aware of any time in my life having been exposed to segregation as it restricted freedom. However, I looked again and found that perhaps I could draw on some personal experience. I attended junior high school and high school in Pittsburg, California. The Chamber of Commerce of this town of approximately 15,000 people claims that it is the industrial center of the West. It has a rather interesting background. It started out as a base for deep-sea fisherman, primarily of Italian, Spanish and Portuguese extraction. Then coal was discovered in the hills and this brought in the Greeks. Prior to World War I, a steel mill was built there and this brought in other big industries employing many people of different national origins, including the Negro worker. My classmates reflected this variety.

Although not segregated into ghettoes, there was social segregation of a type (primarily among the older people) with the Anglo-Saxons against the "foreigners." Fortunately, one could not predict academic achievement by name. We had honor roll members from all groups. Although home backgrounds differed, we did enjoy equal educational opportunities because we all attended the same school and were taught by the same teachers. Unfortunately, this isn't always true. In Pittsburg different groups seemed to be in pretty fair balance. From my limited experience I would say that segregation and accompanying intolerance and prejudice seem to be greatest where there is a strong single minority group, and more so if this minority is of Asiatic, Latin, or Negro origin. Also, intolerance and prejudice usually seem to be strongest among the parents, and initially almost nonexistent among the very young children. This being the case I would have to observe that intolerance and prejudice are not the normal condition of people, but are things learned. They are the principal forerunners of segregation of any type.

We are told by scientists that there is no superior or inferior race biologically, yet as we look about us it appears that certain groups are superior in intelligence and ambition. Of course we can produce a number of different explanations for this. The Aborigines of Australia are supposedly one of the more backward cultural groups in the world. They have lived an isolated and segregated life. Yet I have a great deal of awe for these people and the conditions under which they are able to exist. I'm not sure that I'd be very successful coping with problems inherent in their environment. It appears to me that probably the big reason for this apparent difference in the abilities of racial groups is not in the difference of native ability but in the cultural opportunities and experiences of the group.

We have seen example after example in our country of segregation of different types. White minorities have eventually been assimilated but skin color continues to be a deterrent. Some groups have segregated themselves with success, e.g. Chinese, Japanese, Orthodox Jews, etc. The groups we need to be most concerned with now as citizens and educators are those minority groups (sometimes in the majority) who are forcibly segregated from society as a whole for one reason or another. This tends to create an economically and culturally-disadvantaged group of people who don't have a real chance to become productive citizens.

We tend to be a materialistic society. As a result the dollar is used as an index for the measurement of many different things within education. In some large segregated slum districts, the average cost per pupil is as low as $100 per student per school year. At the same time, in other suburban areas, the per-pupil cost runs as high as $1,000 per year. The students from these districts are not being exposed to equal educational opportunities.

It seems to me that our problem is two-fold. Legislation is being enacted to reduce, at least gradually, involuntary segregation by race. We need next to insure that equal educational opportunities are available regardless of geographical location, racial or economic background. Then we need to work hard to develop programs to overcome the results of cultural deprivation caused by segregation and poverty. This is where it seeems to me that industrial education has a tremendous opportunity to be of real help. In the past we have sometimes been unwilling to accept or acknowledge such a role. The big problem will be to educate our administrators to the fact that we are aware of this opportunity, but at the same time can be ultimately effective only as we are able to set up special programs to deal with problems of special groups.

I think the principal goal of education in our time is to achieve the practical education of some youth for the profession of leadership, many for occupational competency, and everyone for life and citizenship in our increasingly complex society.

Frederick Douglas, a former slave, who in his time became a great reformer, a lecturer, a writer, an adviser to President Lincoln, and also a U.S. Minister to Haiti, wrote in 1883: "In a composite nation like ours made up of almost every variety of the human family there should be as before the law no rich, no poor, no high, no low, no black, no white, but one country, one citizenship, equal rights and a common destiny for all."

Barriers to the Release Of Human Potential

DEMPSEY E. REID, *Department Head, Industrial Arts, Western Illinois University, Macomb, Illinois*

CLOSELY related to the social barriers to the release of human potential are the results of new research on early learning and the intellectual development of children, now receiving wide attention by sociologists and educators. These new theories are so far-reaching in their social implications that they may radically alter our thinking and subsequent actions on social rehabilitation and educational development.

Some of the major concepts on the learning potential of the child that are now being studied are as follows:

1. A child does not have a fixed intelligence, or predetermined rate of intellectual growth, contrary to the widespread opinion we have had in the past. His level of intelligence can be changed, for better or for worse, by his experiences and environment, especially during the earlier years of his life.

2. Heredity *does* put an upper limit on the child's intellectual capacity, but many scientists believe this level of capacity so high that no human has yet even approached it.

3. Changes in mental capacity are greatest during the period when the brain is growing most rapidly, and the brain grows at a decelerating rate from birth on. The stimulus you add to the child's environment will have the greatest results in raising his I.Q. level during his earliest years.

4. According to Dr. Benjamin Bloom, half of the total intellectual capacity of an adult has been developed by the age of four years, and 80% by the age of eight. After the age of eight, regardless of what type of schooling and environment the child experiences, his mental abilities can only be altered by about 20%. This 20% is the amount that we as teachers have to work with in trying to release the full potential of the child.

5. The more a child has seen and heard, the more he is interested in seeing and hearing. Dr. Jean Piaget believes that the more variety of environmental

stimuli with which the child has coped, the greater is his capacity for coping. The more he learns, the more he desires to learn.

If we believe the concepts to be true, then there is a basis for teachers being able to predict a student's achievement when he knows his family, his residential section, his social and environmental background. Research is just now beginning to prove what teachers have known for a long time, that these factors do have a close correlation to the student's ability and interest in learning.

These social and environmental concepts could then also be the cause of the personality development of the youth that causes him to be a conformist or a nonconformist, to be social or antisocial, and to accept or reject adult authority. You can appeal to people only through things which motivate them strongly, and motivation comes when experiences give them foundations for learning.

Social rank is usually closely correlated with the economic factor which may be another cause of learning barriers. How often has the child who needs corrective glasses been denied this necessity because of financial hardships? How often is the child unattentive in the classroom because of physical illness due to lack of proper medical care? The economic factor may also be the cause for many students having to work late evening hours and not have the benefit of the needed hours of rest. This same social group is often the one that has the marital problems, parental arguments, sometimes with violence in the presence of the children . . . this frustration and mental disturbance is certain to carry over to their attitude in the classroom.

Another social barrier, one which we as teachers should do something about, is the school curriculum that is the product of the immediate society. This curriculum may be one that is designed to make it easy to keep order in the school, make it easier to administer and organize the overcrowded classrooms, with a minimum of effort; but does this type of educational practice release the potential of the boy? No provision is made for problem-solving, individual differences, self-expression, personal need, individual design or research.

Contrast this situation to the school in the section of the city where the social and economic level is above average, where classes are the right size, where the teacher has the tools, equipment and facilities for individual research and study, where the teacher is free to teach and devleop the student and not be a keeper of discipline and watchman of tools. This is the industrial arts facility where the teacher attends summer school, keeps abreast of new developments and keeps his educational offerings at the level his students demand—yes, these students do demand, they want to learn . . . remember the concept, the more he learns and has experienced, the more he desires to learn?

These social and economic barriers are difficult to separate in all their facets, just as each facet on the jewel reflects the others. The social neighborhood in the high income bracket has the advantage of political power where money will be spent for the new schools, pay the higher salaries and provide adequate operating budgets for the teachers. The lower socio-economic neighborhood has less political power and is less able financially to provide the teacher with an adequate budget.

Many other social barriers could be indentified, but one I want to mention is one that we as teachers can really affect. This is the barrier to education that society has created by demanding that we evaulate our students with comparative grades of *A, B, C, D,* or *F.* Pressures by parents and teachers for the students to obtain high grades has, in my opinion, often caused us to teach so that we can easily defend our evaluation to the students. We test and examine, not for the purpose of seeing how well we have taught, but for the purpose of giving a grade. The student too often feels he must follow the same procedures, make the same project and try to live up to the standards he knows the teacher requires for an *A* grade. He takes the project and his high grade home and everyone is happy, but has the student been allowed to develop to his full potential? Was he allowed to experiment, was he encouraged to do some research, was he challenged to improve on the design, and most important, was he given the feeling of self-accomplishment, something that was above and beyond the requirements as outlined on the procedure sheet? But the *A* grade will help put him in the upper 50% of his graduating class so he might be admitted to the college of his choice. How can the teacher evaluate thinking, experimentation, research, independent study and then record a meaningful grade of *A* or *C*? It is so much easier to evaluate a project that was made according to directions by the entire class and to give a grade on a multiple-choice test that can be scored with a master key by a secretary.

We know which method of teaching helps the student develop to his fullest potential. What keeps us from teaching that way?

These barriers—the student social environment, the limited school curriculum, the economic factor, the traditional classroom organization and grading system, and the status-seeking teacher, are all factors which need improving. If we would improve these factors, we could improve on the educational development of the pupil.

Barriers of Social Malaise

STANLEY J. PAWELEK, *Supervisor of Industrial Arts, Baltimore, Maryland*

DEFINITION—Malaise: "An indefinite feeling of debility or lack of health often indicative of or accompanying the onset of an illness," or "a vague sense of mental or moral ill-being." Our "sickness" lies in the belief of so many that "working with the hands" is less honorable and respectable than "working with the mind."

Our schools are not really democratic if "idea-minded" individuals are favored at the expense of those who are "thing-minded." There is one class of people who do relatively better in handling numbers, formulas, chemical symbols, and so on. There are others who do better in handling things, measuring and sawing, making things, assembling and repairing. Society needs people who are efficient in dealing with material things quite as much as it needs those who can manipulate abstractions; and surely the former have as substantial a claim to the good things of life as the latter. Yet our schools have hitherto been run, for the most part, in the interest of the abstract-idea type of individuals. Until industrial arts and other so-called "practical" courses were instituted in the curriculum, it was exclusively so. The situation has been changed considerably during the past half century, and it is encouraging to note the increasing percentage of secondary school students currently enrolled in industrial arts classes.

Our schools are not really democratic if students with academic minds are favored over those in whom the life-career motive is uppermost. Our schools have provided a sheltered life which many timid and passive individuals prefer to the buffetings of outside activity. For some people, too, there is pleasure in learning for learning's sake, and they are the type who would devote their entire lives to study. On the other hand, many individuals crave activity. They want to try themselves in the real work of the world, and are impatient with anything that does not hasten, or bear upon, that which to them seems functional and practical. One of the reasons for early school-leaving is this impatience with a schooling which seems to contribute little or nothing to success in the workaday world. The remedy for the situation is the reconstruction of curricula to provide for rich offerings of interesting and useful courses in industrial arts, homemaking, agriculture, business, distributive education, and the like. Industrial arts programs whose objectives include information, exploration, and occupational guidance, along with a generous amount of working with the hands, play a most important role in the lives of these students who are workaday-world bound at an early age.

Our schools are not really democratic if they do not provide basic preparation for many practical occupations. A high school education has little value if it prepares only for a life of leisure, or perhaps for college. Our educational system is not democratic until it provides a measure of basic training for each student, regardless of the occupation he contemplates entering, provided only that it be a socially-useful one. Theoretically, our education is accessible to all, of course, but this is only a mockery until the offerings are such that all will want to take it. To have a really democratic system of education, we *must not* only have offerings which some can take and others leave alone, but also we must make the offerings diversified enough or basic enough so that each will find in it what he needs. Otherwise, the procedure is as inequitable as it would be to propose furnishing free shoes to everyone, yet expect everybody to take a size six.

As everyone knows, industrial arts fits perfectly the pattern of a truly democratic system of education, as measured against the three criteria listed. Taught properly, it provides challenges for all types of minds, and for a variety of interests and aptitudes. Whether preparing for a life of leisure, for college, or for early entrance into gainful employment, the student finds that time spent in the shop or drafting room is enjoyable, instructive, and profitable. Society, with its insistence upon the perpetuation of a democratic heritage and culture, finds a favorable climate and a fertile soil in a sound program of industrial arts education in our schools.

Barriers of Disorganization And Apathy

CHARLES M. RICE, *Associate Professor of Industrial Arts Education, Western Washington State College, Bellingham, Washington*

THERE appear to be numerous social barriers to the release of the human potential. Basic to these is the person's image of self. If this be true then we as educators in the field of industrial education need to be concerned about more than the mere subject matter courses which we teach. Too long, the classroom teacher has been inclined to think of high school and college students as adults, able to deal with problems as adults, when actually they are young persons at a critical period in their lives and confronted with problems of vital concern that demand solutions in areas in which they have little experience. Problems such as the selection of a mate, early married life, and finances, all can be completely disorganizing and cause apathy in school work.

According to educational psychology, a truly adequate student has a perceptual field that is capable of change and adjustment. Attitudes on the part of the teacher that prevent the student being treated as a person of dignity and integrity erect barriers of disorganization and apathy. Among these barriers are conditions that lead the individual to feel disliked, to feel unacceptable, to feel unsuccessful, or to feel unimportant.

We can lower the barriers of disorganization and apathy by paying more attention to the student as a human individual, by planning instructional procedures to expand the student's field of perception through free exploration and discovery, beyond the range of the old facts. . . . The person becomes creative in his own right when he obtains insight into the relationship of facts which he never knew before and makes the experience his own. The apathetic student, needing as he does a socially acceptable image of himself, requires a sensitive instructor to survey his limited interest and help him to build a new perceptual experience that will result in visualizing himself as a more adequate person.

During nearly 45 years of teaching at all levels in the fields of art and industrial arts education, I have had many opportunities to observe the release of the human potential. While teaching drafting at North Junior High School, Everett, Washington, prior to World War II, I sponsored an airplane club for boys interested in building model airplanes. The club grew to 50 members and accumulated $100.00 in the treasury. The members became interested through study of the laws of flight over a period of two years and seized an opportunity to buy a primary glider from the Seattle Glider Club for the money they had in the club treasury. Through school cooperation a hanger was provided on a nearby flying field for use on Saturday mornings. The field being level with no hill handy from which to launch the plane, we had to project it into the air by means of a shock cord attached to the rear of an automobile provided by an instructor. Once the shock cord was stretched to a certain point the glider took off and after reaching an altitude of about 15 feet for beginners, the pilot released the shock cord and guided the plane back to earth. This experience extended perception of aviation for the club members. Many entered the aviation industry during later years, and I learned that two grew up to become ace pilots in the U. S. Marine Corps.

Another example came to my attention rather recently at a high school in northwestern Washington State. While being conducted through the woodshop I noticed a huge pile of red cedar boxes stacked along one wall of the shop. The industrial arts instructor explained that these belonged to a student who was constructing 125 beehives, using the assembly-line method when classes were not in session. He showed me the jigs and diagram of the production line put into use during the noon recess or late afternoon hours by a student who had been a potential school drop-out until he became interested in bees! Later in the day I had the pleasure of meeting this student and watching a number of his companions contributing assistance to the project motivated by his enthusiasm and an interest in gaining experience in production techniques.

This high school student, the son of a local farmer, was doing badly in high school and was failing in his English class. He was ready to drop out of school when he became interested in bees. One day a swarm of bees had come to rest in a neighbor's yard and this boy became the owner when he showed interest in keeping them by finding a temporary hive. From this initial effort developed an incentive for learning more about bees that progressed into extensive reading and study about bee culture, leading to a point where his apathy to school work disappeared. He decided to continue in school, his work in English improved and a new image of self emerged. He arranged to build three or four hives in the woodshop which led him further along the way in knowledge and became convinced he wanted to go into the bee business on a large scale. As soon as the hives were completed he filled them with bees eager to go to work making honey while he sought a wholesale market that established him in a flourishing bee business before he was graduated from high school! Finding that this work didn't absorb all of his energy he extended his efforts to include other activities that earned money. A recent report reveals that he is now a succssful business man in his community and tends his enterprises in a Cadillac!

As a teacher you may never fully learn how far your past influence may have challenged young persons to banish apathy, remove barriers or disorganization, and improve the self-image. The growing self is not prone to analyze the byways of education along which it falters, finding a path to success or failure.

The industrial arts teacher has a unique opportunity to assist his students to explore new avenues, not open to the more restricted academic disciplines, in which they may find new interests, new successes, and so develop a degree of self-actualization that results in a more positive image of self.

Symposium—What Steps Can Industrial Arts Groups Take That Will Help in Task of Maintaining a Responsive Curriculum?

Viewpoint of a State Supervisor Of Industrial Arts

ROBERT L. WOODWARD, *California State Consultant in Industrial Arts Education, Sacramento, California*

FROM the viewpoint of a state supervisor of industrial arts, there are two major ways to assist in maintaining a responsive curriculum: providing meaningful instructional material, and encouraging self-appraisals and evaluations of programs and courses.

The preparation of meaningful instructional material requires the knowledge and experience of industrial arts teachers, supervisors, and teacher educators, as well as certain other specialists—with an emphasis on the "grass roots" involvement of outstanding industrial arts teachers. Of course, this presupposes that better teachers, supervisors, and teacher educators are keeping abreast with the educational, industrial, and technological changes.

In California, we have used a number of approaches to bring about the development and maintenance of a responsive curriculum and curriculum material. For example, the following steps were taken in developing the material for the publication *Industrial Arts and Science:* Teacher educators in each area of industrial arts listed the scientific principles covered in their courses and explained how these principles were applied; experienced industrial arts teachers in a graduate course used the information provided by the teacher educators to prepare a working draft of the instructional material; industrial arts supervisors and teacher educators reviewed the teacher-prepared working draft; and specialists in industrial arts and specialists in science used the material in the working draft, as well as the recommendations made by the supervisors and teacher educators, in preparing the final material for the publication. A similar procedure was used in developing the material for the publication *Mathematics and Industrial Arts Education.* Both of these projects were conducted under the National Defense Education Act.

Another approach was used in developing the material for *Safety Instruction in Industrial Arts Education.* Three of the major steps were the selection of safety instructions and safety test questions used by the larger school districts in California and other states; the preparation of a preliminary draft which combined the best elements of the material selected; and the appraisal of this material by industrial arts teachers in all California high schools (other than those located in the larger districts) where courses at least in the areas of metals and woods were provided.

Yet another approach was used in preparing the experimental edition of *Industrial Arts Automotive Mechanics, An Introductory Course of Instruction.* A committee of teachers, supervisors, and teacher educators prepared material for a trial publication. A copy of this trial publication and a comprehensive questionnaire were sent to each high school automotive mechanic teacher in California. As a result, a second printing of this publication was made containing certain changes and corrections recommended by those responding to the questionnaire, as well as the names of all those reviewing the material.

Keeping curriculums current is always a problem. Often, the doers—those members of the profession who assist in curriculum development—prefer to move on to experimental approaches rather than to revise proven approaches. For example, we have two companion publications, *Suggested Courses of Instruction in Industrial Arts for the Junior High School Level* and *Suggested Courses of Instruction in Industrial Arts for the Senior High School Level,* that for a number of reasons needed to be revised. A new procedure was used to revise the material in the junior high school publication: (1) a series of meetings was held in three regions of the state for supervisors to discuss changes needed in the material; (2) supervisors in each region assumed the responsibility for revising the material (one for each area of industrial arts); (3) each supervisor selected a number of teachers to assist in the revision; (4) revised material from each of the regional groups was brought together in a semi-final draft; (5) supervisors and teacher educators reviewed the semi-final draft; and (6) recommendations of the supervisors and teacher educators were used in preparing the final draft. As a result, the revised material was published this year under the new title, *Industrial Arts Course Outlines; Grades Seven, Eight, and Nine.*

The material in the publications, *Guide for Industrial Arts Education in California* and *Guide for Planning and Equipping Industrial Arts Shops in California Schools,* also was developed through procedures involving teachers, supervisors, teacher educators, and certain other specialists.

As to encouraging self-appraisals or evaluations of industrial arts programs or courses: During February of this year, a copy of "Recommended Guide for the Evaluation of a Program of Industrial Arts Education" was sent to each industrial arts department chairman in California junior high schools, four-year high schools, and senior high schools. This guide was jointly prepared by the California State Department of Education and the California Industrial Education Association.

In the cover letter that accompanied this guide, it was suggested that the guide could be used by a teacher in appraising his course, by all teachers in the department in appraising the quality of their contributions to the department's total instructional program, by the department chairman in evaluating the department's program, by the teachers in preparing a report for an accreditation committee and by members of a visiting team in evaluating the department's program.

The publications described in this presentation are distributed free of cost to all California administrators and industrial arts teachers, supervisors, and teacher educators and can be purchased by educators in other states. (The Agency of International Development has translated seven of these publications into Spanish for use in Mexico and Central and South America. These Spanish editions can be obtained by residents in Latin American countries through their American embassies.) The "Recommended Guide for the Evaluation of a Program of Industrial Arts Education" is available, free of cost, to any interested educator.

Viewpoint of a University Department Of Industrial Arts

VERNON L. WILLS, *Assistant Professor of Industrial Education, Division of Industrial Education, Indiana State University, Terre Haute, Indiana*

REDUCE all of the people in the world to a town of 1000 persons and think on the problems of such a town. Such a town would number 60 Americans and 940 persons of other nations, because this is the proportion of the United States to the rest of the world. The 60 Americans would be drawing half of the income of the town with the other 940 drawing the remaining half in various proportions.

White persons would number 303. Non-whites would number 697. The 60 Americans would have a life expectancy of 70 years. The other 940 would have an average life expectancy of less than 40 years. The 60 Americans would average 15 times as many possessions as the average of the other residents. The Americans would produce 16 per cent of the population. The Americans would eat 72 per cent above minimum food requirements.

Americans could not give surpluses away without upsetting the economies of the benefiting groups of citizens, so they would have to store surpluses at great expense. The Americans would also have a disproportionate share of electric power, coal, fuel, steel, and general equipment. The Americans and about 200 others representing Western Europe and favored classes in South America, South Africa, Australia, and Japan would be rather well off, but the majority of the 1000 persons would be ignorant, poor, hungry, and sick.

Quite possibly the viewpoint of a university department of industrial arts should be to attempt to transmit the industrial culture of the times to the secondary industrial arts programs which they serve. As noted previously, we should be aware of the culture of America and the world. It should be kept in mind, with respect to the previous statement, that the nature of our industrial culture is changing also. The importance of new and different industries is becoming quite evident. For example, the plastic and ceramic industries are challenging some established industries. Here, perhaps, industrial arts educators should take note. All is not wood and metal in the industrial world.

An industrial arts department of today is faced with an awesome challenge: the task of maintaining a responsive curriculum. It is evident, it seems to me, that the content of what is a responsive curriculum may take many facets. What is a responsive curriculum? How can it be accomplished?

It might be suggested that a responsive curriculum should respond to the needs of the professional clientele we must, can, and should serve. Let us not forget that the men on the line so to speak, the secondary industrial arts teachers, have specific needs. The interpretation of our industrial society at the university level may be a far cry from our hopeful interpretation of industry at the secondary level.

How many industrial arts teachers at the university level have ever worked with minority groups such as Negroes, Mexicans, Indians, Orientals, and others? Yet these groups are taking on increased importance in the world and certainly increased importance in the metropolitan school population of today.

Sometimes, to the secondary industrial arts teacher in a metropolitan high school it must seem as though he is the teacher all educators have deserted. We as industrial arts educators must not forget that these teachers may teach more students in a single day than some industrial arts teachers reach in a week . . . or two weeks.

I am somewhat appalled by the seeming failure of university departments of industrial arts to meet the needs of the industrial arts teachers in slum and poverty-stricken areas, both rural and urban. Perhaps some industrial arts educators at the university level are producing an educator equipped to fight the battles of our classrooms but far too few are accomplishing this, I fear.

It seems then, in brief summary, that a university department of industrial arts must be responsive to the specific needs of the professional secondary industrial arts teacher as well as responsive to the industrial culture and world culture that surrounds us. It seems that the greatest degree of human potential may be developed at the secondary level if college and university departments of industrial arts critically examine their curricula with respect to the professional educators they serve as well as the segment of American and world society they wish to interpret.

Symposium—What Provisions Can the Industrial Arts Teacher Make To Safeguard the Interest of Individual Students?

In View of Continuing Increased Enrollments

R. D. BOLLARD, *Assistant Professor of Industrial Arts, Montana State University, Bozeman, Montana*

INCREASED enrollment in our public schools presents a challenge to the industrial arts teacher who realizes that he must face up to ever-increasing pressures from administration, students, and the tax-paying public alike. The administration wants and has a right to expect top performance; the students rebel at having to suffer the boredom of poor programing; and the taxpayer must be satisfied that his money is paying for worthwhile services.

The challenge lies in the need for the teacher to become far more conscious of community needs. He must be better prepared to recognize the needs of people and be able to fully realize what the community is looking for. This is a continuing challenge so long as communities continue to grow and school enrollments continue to increase. Schools which have undertaken the responsibility of training these teachers must also take a long, hard look at their programs.

The community needs of the past are rapidly being changed, or replaced, by the needs of the present and, more importantly, the needs of the future.

Unless our archaic thinking and activity give way to modern and future needs, our programs will rapidly deteriorate into a form of dogmatically-preserved past, lacking in a real need for its existence.

What then are we to do? What approach or plan for continued improvement, or even survival, shall we execute? As I see it, based strictly on area or local observation, being partially unaware of the complete national scope of the problem at this time, we must first establish a universal public image—an image so complete in its scope and understanding that enthusiastic public acceptance will support our programs with the encouraging vigor so highly essential for success.

Much has been said and written calling attention to the need for improved public relations. For example: Donald Hackett, in an editorial which appeared in the September-October 1964 edition of "The Journal of Industrial Arts

Education," had this to say: "Public interest in education has never been greater. To maintain this interest it is important, even mandatory, that a free interchange of information and ideas take place between the school and the public. To gain understanding of industrial arts, each of us must accept some reponsibility to provide for this interchange. Any success achieved will help to improve the relationships between the entire school and the community. We may accomplish this end through an effective public relations program."

Our school organizations must work more closely with the various community media through which information or newsworthy articles can be a constant source of contact. We must go far beyond good intentions. Can we, in this group, formulate steps, procedures and policies that will involve every industrial arts teacher in the nation to this extent?

The student, the only valid excuse for our existence and consequently the greatest potential for the success of the program, may very well be the disciple who initiates an attitude which will charge the atmosphere with wholesale interest and activity. We are all becoming more aware of the need for activities which will lead to adequate exploration for all students regardless of, but in line with, their ultimate educational goals. Improved programs with a real purpose must be exchanged for those which merely offer a momentary release from academic tensions. Programs need not be dogmatic in their design. Single direction may very well be employed to further stimulate a recognized interest in the probable development of a genuine leaning in the direction of an occupational, or even an avocational, expression. This premise is all the more reason why the industrial arts teacher must be better prepared, or, if you will, dedicated to more closely ally himself with those whose responsibility it is to offer guidance. For isn't it true, that industrial arts teachers are in a position to observe far more clearly the student inclinations towards areas of interest?

However, the best laid plans, prepared by even the most highly qualified and executed by pure dedication, whether it be fund-raising, a free dinner, or a parade, will succeed only if public acceptance is achieved. Success is always foremost in our minds when we gather around the planning table. We constantly discuss our program in terms of end result, quite often overlooking the important aspect of community acceptance. The public image of industrial arts is not gained through printed brochures, or idle talk. A program so progressive as to satisfy needs of the individual and needs of the community is of vital importance.

The public image of industrial arts must not carry, even remotely, the connotation that it is a program intended for sub-standard students. Throughout the school and the community an attitude of pride must be established. Students must be enthusiastic and proud of their industrial arts associations; all teachers must maintain only the highest respect towards industrial arts; administration must abandon any program they may have of using industrial arts classes as a "dumping ground" for trouble-makers or sub-standard students. The industrial arts teacher must exercise his professional position and refuse to be used as the "whipping boy." I do not intend to imply that bad boys and substandards not be admitted to industrial arts classes. This may be the very place for them to reach worthwhile achievement. What I mean is that they be not sentenced to these classes because they are what they are. Surely our guidance programs have taught us better than that.

Industrial arts programs need universal recognition. We need to be understood readily and completely with the same prestige and pride given the recognized academic classes.

To cope with the problem of constantly increasing enrollments, we must accelerate change. The time-honored process of evolution just isn't soon enough. The teacher must recognize immediately what is needed and take steps to do something about it. The student will face the challenge with renewed vigor as he is capable and anxious to perform at a much higher level. All the student needs is capable and worthwhile direction. A program so complete and worthwhile in its scope will no longer need to be defended as in the past. Public acceptance will help build and encourage a progressive program which has real values and real needs, in this, the greatest industrial nation in all of history.

In summary, I would like to suggest these salient reminders:

1. Let's up-grade and modernize to meet the needs of our own local areas and the nation.
2. Let us *be* a part of the total guidance program in helping to prepare students for worthwhile endeavors in their life vocations.
3. Let's pat ourselves on the back—promote and publicize industrial arts for what we know it is!
4. Let us challenge each and every student to be a Thomas Edison, a John Glenn.
5. Let us be specific and develop a guide for the new teacher, the teacher-trainee, and for ourselves, that will help us take to every community a program of procedure that will enable even the most timid instructor to carry out his own local publicity schedule to constantly improve our public image.

In View of Some Demands of Society To Crowd Out Elective Courses

JAMES O. GILLILAN, *Consultant of Industrial Arts, St. Louis Public Schools, St. Louis, Missouri*

FROM this rather lengthy topic let us choose the *three* most important phrases and consider for a few moments the message we can draw from their interaction upon each other. The words I want you to keep in your mind are (1) industrial arts teachers, (2) individual students, and (3) elective courses. My assignment on this symposium is not primarily to give answers, but rather to provoke thoughts that may provide answers for you as problems arise.

Let us consider these three phrases in reverse order. That is—first, the elective courses; secondly, the individual student; and last, the industrial arts teacher.

We are not here to discuss whether industrial arts is rightfully placed in the curriculum as an elective course. It has always been such in the high school so we accept its position thusly. The question we are concerned with now is—how much shall we do to prevent its being crowded out of the curriculum because of greater emphasis on science and mathematics? Many counsellors and administrators have tipped the balance, in some schools, in favor of such courses—students have been guided toward the science and math courses, which has meant that they could not elect as many courses as formerly. There being only so many hours in the school day, it is frequently impossible for students to choose elective courses, for we have reached the point in our program-making where each subject area is quite demanding in both time and content. Let us now go on to a consideration of the individual student.

I believe we will have to admit that too often in our education of masses of children, we frequently consider primarily what is *best* for the group, and secondly, how does the individual adjust to this program. Ideally, the plan should be reversed; as indicated in our general convention theme, "The Developing of Human Potential Through Industrial Arts," we are giving hours of thought and discussion of how we can begin with the *individual* and develop his potential in a planned way, as related to industrial arts. The high school youths fall into three groups usually, those who have decided upon a field of interest to pursue (the small group); those who are seriously concerned but undecided; and third, those who drift along with unaroused interest toward a pursuit. The two latter groups really have a *need* for a variety of experiences to open their eyes to future possibilities so they should have the privilege of electing as great a variety of courses as can be allowed them. I feel keenly that we are failing the youth of this age when we allow them to graduate from high school with no plan for their life's work. I have even gone so far as to state that we should not allow a youth to leave school by way of graduation or the "drop-out" route, until he is prepared in some way to earn a living. Costly and demanding, true, but no more than such programs as our Federal Government is undertaking presently to educate and re-educate the drop-outs and the drifters. I would not pass by this topic without mentioning the pleasure that many students derive from their elective courses—to many of them, such courses represent the frosting on the cake, so to speak, and their pleasure in the elective course serves as a leaven for some of the less pleasurable (to them) but required subjects. Should the students be denied this pleasure by a society which cannot possibly consider each individual's best interest? I'm sure you feel as I do, that the answer is *no!*

Our third important consideration is the industrial arts teacher. In any teaching-learning situation, what the learner gains is dependent to a large degree on the effectiveness of the teacher. *But*, what the teacher teaches is usually dependent on the course of study as set up by a supervisor or a state department. This is good, we feel, for some reasons—it prevents aimless teaching, and it provides a uniformity which is desirable in a large city where there is moving from school to school.

Much skill is required from the teacher to adapt such a planned program to the development of the individual potential of his students—but that is a subject unto itself. I believe the implication to be drawn here is what an industrial arts teacher can do to see that all students who *desire an elective course* in the field may be *permitted to have it.*

(1) Why not change some of our industrial arts courses to a single daily period that can be fitted into the schedule more easily. If it doesn't work, you haven't lost a great deal and it might allow many more boys to realize the desire to elect industrial arts courses.

(2) Why not speak up more volubly in discussions with administrators and counselors to influence them to guide youth into an industrial arts class? We must accept the truth that the counselor in today's school is a very influential person, and plan our strategy accordingly.

(3) Let's accept the challenge and responsibility for keeping the so-called "drop-out" in school until trained for employment—it need not lower the quality of your program if planned and executed carefully—very daring ideas could be tried at this time when the whole public is so aware of the acuteness of the problem.

(4) Let's put students' individual welfare above the demands of so-called "society" and not be backward in stating this position to administrators and guidance counselors.

(5) Let's publicize more effectively our industrial arts program within and without the school through the use of bulletin boards, service projects, P.T.A. meetings, student assemblies, sponsoring related clubs; participation in contests, local and state; and membership in civic groups where selling the program to the public may be accomplished.

(6) We must grow constantly as teachers and persons, to become outstanding professionally—thus winning confidence of colleagues, students, parents and the public. Very few of us "sell" ourselves and our work as we might do. Does it mean we are not completely dedicated to it?

(7) Industrial arts teachers and organizations should assume more responsibility to guide capable students into the teaching field of this subject—this, in turn, involves making the field attractive financially so we must cooperate with the whole teaching profession to make it more attractive in every way. Do we have a scholarship plan for aiding future industrial arts teachers?

(8) Let us do more in correlating our program with other subjects. This is a further way of learning more about the student's individual program, thus a good opportunity to provide for individual differences in a sound way.

(9) Be well-informed teachers, about what is being done nationally in the field. This might be accomplished with the aid of a state director of industrial arts, whose duty would be to upgrade and promote the subject throughout the state. It could also be aided by requiring participation in professional organizations such as this, the AIAA.

In View of the Ever-Shifting Demands On the Industrial Scene

R. E. FISHER, *Chairman, Industrial Education Department, Pacific Union College, Angwin, California*

"NOTHING is so permanent or certain as change." Change, however, is not the most important thing, but rather how we relate ourselves and our industrial arts students to it. In order for the industrial arts teacher to safeguard the interests of his students against the changing demands of industry, he should, in my opinion, be able to distinguish between change and innovation; to recognize change on the industrial scene; to interpret the shifting demands; and to translate these demands into realistic objectives for himself and his students.

Safeguarding the interests of industrial arts students would further imply that the teacher exhibit and employ new materials, demonstrate new methods, explain new techniques, provide a learning situation that is fresh, stimulating and challenging; and yet with all of these essentials carefully performed and under control, we have now appearing (or, rather, there has already appeared) on the industrial scene the greatest challenge for industrial arts teachers and students of our educational history. I refer to the challenge of automation. We're moving into a period, and it probably will be a "permanent" period, where the main characteristic of the world will be change. In the past we have thought of permanence, stability and careers that lasted a lifetime, but every day this is becoming less true of our concept and pattern of living. According to Labor Secretary W. Willard Wirtz, we have had more technological change in industry during the last twelve months than in any other period of our history.

Recently I accompanied a group of our industrial technology majors on a visit to Mare Island Shipyard, a U. S. Navy installation at Vallejo, California. Since there is little or no service or maintenance type of work required at the present, the principal activity is the design and construction of nuclear-powered, polaris-equipped submarines. On a conducted tour through the planning and design office, the ship-fitting shop and the machine shop, we observed photo drafting and photogrametry nudging out the conventional methods of drafting and design; high tensile steel being shaped and welded with inert gas and helio arc; completely automated machine lathes and milling machines, replacing entire sections of obsolete equipment as white-haired master machinists stood by with a look of nostalgia and far away.

This implies not only ever-shifting demands on our type of education but at an ever-increasing rate. Did you know that Univac I, the world's first electronic computer, is now an obsolete museum piece at the Smithsonian Institute? More than any other single device the computer has come to stand for automation and automation is becoming the most controversial economic concept of the age. Management is in love with it, workers are fearful of it, the government investigates and wonders what to do about it.

Perhaps education, and particularly industrial arts, is in a unique position to help meet the challenge by providing the kinds of experiences that will, when properly correlated with the social and physical sciences, prepare a student who is both highly versatile and readily adaptable. These two characteristics will be high on the list of requirements for those soon to meet the shifting demands of industry.

And again, in my opinion, it would be harmful, if not hapless should we fail in helping the student to discern rightly between the shifting demands of industry and the stable demands of integrity—between the changing methods of work and the time-proven methods of living.

Such a student, so prepared, is his own best safeguard, not only against the ever-shifting demands on the industrial scene, but against the ever-changing threats to our society.

Symposium—Can the Gap Between Research and Utilization of Research in Industrial Arts Be Closed?

Some Happenings on The Elementary School Front

ELIZABETH HUNT, *Associate Professor of Elementary School Industrial Arts, State University College, Oswego, New York.*

THE question posed for us in this symposium, "Can the gap between research and utilization of research in industrial arts be closed?" demands that we first take a look at research to see what it suggests in terms of utilization. Inasmuch as we are in the business of education and specifically industrial arts and technology as an area in general education, our interest in research is rather comprehensive in scope. To deal with this comprehensive scope I should like to suggest two broad categories which I borrowed from Jerome S. Bruner's

On Knowing: (1) the nature of knowing (2) the nature of things to be known.

In the first category—the nature of knowing—we are interested in that research which has to do with the *human learning process*—the factors that have to do with the human being's acquisition of knowledge and his knowing. The second category—the nature of things to be known—in our case would have to do with technology.

Now, I am going to use the word "technology" to mean as Sir Robert Watson-Watt defined it:

" . . . the *selective adaptation* of one or more of the *processes* and *materials* identified and described by science, and their embodiment in devices designed to serve the needs of mankind in its progress from savagery toward advanced social evolution."

"Industrial arts," however, is a term which focuses for the most part on *contemporary* technology and/or the earlier rudiments of *organized* technology.

I prefer to use the word technology because it describes a major endeavor of the human race in its simplest forms to its present complexity both affecting and being affected by its political and social context. If we pursue our quest of the nature of things to be known in technology, we need the larger historical, cultural perspective included by this definition.

In order to limit my part of the discussion, I have chosen to focus on the first broad category, the nature of knowing, as it pertains to technology. Two reasons for this are (1) that some exciting insights are developing in this area which indicate possibilities for implementation and utilization; (2) the nature of things to be known in the area of technology is largely (as far as I have been able to ascertain) unexplored and undetermined, but rather offers us an immediate, splendid opportunity and challenge. For if this could be discovered and/or determined, we could most assuredly do a more efficient job of designing learning experiences and environments for learning.

Some of the emerging insights regarding the nature of knowing, incidentally, are more suggestive of implementation than psychology has thus far provided, and suggest changes in our thinking about and planning for children.

I shall enumerate these emerging insights for which there is supporting research and/or evidence and since I am focusing on the elementary school these remarks specifically concern young children, pre-school and elementary school age.

First, the human organism, according to R. W. White, is motivated to "interact effectively with his environment." This is motivation which manifests itself in exploratory, manipulatory and activity behaviors. The behavior is intense and persistent. The exploratory behavior manifests itself as a drive to respond to all kinds of stimuli—auditory, tactile, visual, kinesthetic, olfactory and gustatory. Montessori would include the thermic, baric and stereognostic (recognition of objects through feeling with the simultaneous help of the tactile and muscular) senses. The motivation appears to be neurogenic. That is, originating in the nervous system. It is an "unlearned" pattern of response. This theory, supported by research, is far more adequate in explaining some readily observable behaviors of children that could not be explained by the earlier models of motivational theory which attributed all behavior to either painful stimulation, homeostatic needs, sex, or by acquired drives based on these.

J. M. Hunt proposes "a *mechanism* for *motivation* inherent in information processing and action." This mechanism (as explained by J. M. Hunt in several of his more recent writings) provides . . . "a basis for continuous cognitive growth with joy. It also justifies the older notions that children have a spontaneous interest in learning."

The second point is closely related to the first. As a result of this "spontaneous interest in learning," children show an impressive record of accomplishments before they ever come to school. What are their achievements? The human organism has learned, at the immature end of growth, to roll over, sit alone, crawl, pull itself to a standing position, walk, run, grasp objects, let them go, walk upstairs, eat with utensils, ride a tricycle, and many other motor acts. One outstanding accomplishment is mastery of the ground rules of a difficult natural language. Professor Omar Khayyam Moore of Yale University calls this "a task of almost unbelievable complexity."

We have further evidence that if a child happens to live in a multilingual environment he will learn to speak, much more quickly and easily than the adults, the languages involved.

Glenn J. Doman, Director of the Institutes for the Achievement of Human Potential at Philadelphia, in his book "How to Teach Your Baby to Read," presents a convincing case that children can also learn to read as early as three years old, that they not only do learn, but they like it. His experience is having brain-injured children as early as three learning to read.

"Many brain-injured three-year-olds in this group could read sentences and books with total understanding . . . In virtually all parts of the United States tiny children are learning to read even without their parents' guidance."

O. K. Moore's work at Yale and Dr. Maria Montessori's work with young children supports this. Without having been taught how to write, children ages four to five years in a Montessori school burst spontaneously into writing.

The third point is closely related to the second. Situations which restrict or otherwise deprive children of interaction with the environment (either concrete or abstract interaction) affect the development of intelligence adversely.

This concept recognizes that intelligence is not fixed as was once assumed. J. M. Hunt says . . .

"relevant to the role of early experience in psychological development. During the earliest phases, the longer a developing organism is deprived of a given sort of experience, or to put it another way, the longer an organism is deprived of a given kind of informational interaction with the environment, the more likely is the effect of that deprivation to become permanent."

Glenn Doman puts it this way:

"It is during these not-to-be-relived years, these years of insatiable curiosity, that the child's *whole intellectual being will be established.* What the child can be, what his interests will be, what his capacities will be, are being determined in these years. An unlimited number of factors will bear on him as an adult. Friends, society and culture may influence what job he will do in life, and some of these factors may be harmful to his full potential.

"While such circumstances of adult life may combine to lower his capacity to enjoy life and to be productive, he will not rise above the potential that is established during this crucial period of his life."

The fourth point follows the third. Children can and are being introduced to concepts at pre-school and school age that were once thought to be strictly the domain of secondary schools and colleges. Jerome Bruner assumes that "any subject can be taught in some intellectually honest form to any child at any stage of development." Children are learning physics in the first grade, using slide rules to plot equations in the third grade.

I'm sure you are aware that math and science have become more prevalent in the elementary school curriculum and are introduced as early as possible.

The fifth point (I'm sure has been and is doubted by many) is that intellectual mastery is rewarding. Montessori demonstrated this over and over. The excitement of discovering relationships, or the key to control or mastery was evident when her children "exploded into writing." Furthermore learning is its own intrinsic reward. Extrinsic rewards and punishments become superfluous. This ties in with the first point concerning motivation. Jerome Bruner says,

"I should like to add to White's general premise that the *exercise* of competence motives has the effect of strengthening the degree to which they gain control over behavior and thereby reduce the effects of extrinsic rewards or drive gratification."

What then, do these emerging insights indicate to us in terms of closing the gap between research and implementation?

My choice to go into industrial arts was due in part to response I observed in children when they had the opportunity to be active, explore, and manipulate concrete materials in their environment. I discovered this response in a traditional school setting. It was quite obvious that these activities were more in harmony with what children were seeking than the *facts* which we adults considered important and prevailed upon them to learn.

When I started teaching industrial arts in elementary school, I was not disappointed. The excitement on the part of the children of doing things with materials and tools was universal. The children looked forward to my coming and I shared their joy. Just yesterday, an echo of this came in a letter from one of my students presently student-teaching industrial arts in the elementary school . . . "the children feel privileged in the (industrial arts) laboratory."

Since this discovery and rediscovery of the obvious joy, interest, intensity and perseverance on the part of children for industrial arts activities, I have been searching for reasons. This quest has led to some very basic principles on "the nature of knowing," some of which I have just enumerated.

How should these affect what we do in our elementary schools and/or nursery schools?

First of all we should stop kidding ourselves that we can "motivate" children. They, and they only, have the motive power. Since in the area of technology we work with tools, materials and processes, our area has a direct appeal to the exploratory, manipulative behaviors.

The problem is one of designing the school environment so that there is maximum opportunity for this interaction to take place. Maximum opportunity for interaction would mean that there would be a diversity of things with which to interact. Any school which does not include opportunities to interact with those things which are of technology is impoverishing the learning environment and limiting the intellectual development of children in a major area of human endeavor. Montessori said " . . a man is not what he is because of the teachers he has had, but because of what he has done."

I believe the emerging insights suggest that we "teach" technology in "some intellectually honest form" at the *earliest possible moment.* The early years are the *crucial* years. Technology as a major endeavor of mankind and as a subject in general education misses making its greatest contribution to learning and the development of intelligence in children when it is kept in wraps until junior high and then for the male only.

There is one other item of great significance here if we in technology wish to close the gap between research and implementation.

None of the above-enumerated emerging insights answer that very practical question: what, in what manner, and when shall we teach the young child? How shall we prepare the environment for his interaction? What is the teacher's role? To answer we need to explore the nature of what is to be known in technology. In doing so, we are likely to find direction in Jerome Bruner's statement:

"Instead of beginning our instruction in a subject with very abstract, complex, and precise formulation, we are able to present to the child the simpler, highly concrete, intuitively defined versions of the basic concepts and give him some experience in manipulating these. We then move along to a more carefully defined, more abstract, and more precise way of proceeding and so up the spiral it goes . . . . and further it is impossible to conceive of a curriculum without at the same time taking into account what are the great structuring ideas that give form and power to our ways of thinking about the world. For a curriculum must be the path to gaining those amplifying powers that make human beings distinctively human. This distinctive humanity is not so much natural spontaneity as it is the zestful use of instruments of mind we inherit from our culture. It follows, then that curriculum construction in our lower schools must be a joint enterprise of the finest, deeply simplest minds that our culture produces and the best elementary teachers we can produce."

Time does not permit delineating this task of determining the nature of what is to be known in technology, but I think you would find the work of the Center for Cognitive Studies, Harvard University, fruitful direction. Also, scientists and educators have gathered in various summer workshops to jointly develop curriculum for various fields in science and math.

Out of these summer workshops have emerged several maxims which may well guide our efforts. I quote a few briefly and recommend your reading the rest.

"The first is the simplest and most difficult. Get it right. Let what is taught be honestly correct. Right means fundamental as well as correct.

"The second is to invent means of translating ideas into the simpler terms and operations that the child can use on his own. There is a legitimate field of invention here that surely will be one of the new professions.

"The third precept is enlightened opportunism in teaching. One takes the child where one finds him, lets him be free but structures the situation so that he can explore and discover without being overwhelmed. There is no telling where or when you will find your opening.

"Fourth, devise an atmosphere of learning that has as its aim not the notion of 'storing' knowledge, but an active concept of trying to 'understand what it is all about'—something much more important than getting the details right."

I should like to close with this quotation of Ayn Rand's from her novel "Atlas Shrugged."

"Why had she always felt that joyous sense of confidence when looking at machines? Every part of the motors was an embodied answer to 'why' and 'what for?' The motors were a moral code cast in steel.

"They *are* alive, she thought, because they are the physical shape of the action of a living power—of the mind that had been able to grasp the whole of this complexity, to set its purpose, to give it form. For an instant, it seemed to her that the motors were transparent and she was seeing the net of their nervous system. It was a net of connections, more intricate, more crucial than all of their wires and circuits: the rational connections made by that human mind which had fashioned any one part of them for the first time.

"They *are* alive, she thought, but their soul operated them by remote control. Their soul is in every man who has the capacity to equal this achievement. Should the soul vanish from the earth, the motors would stop, because *that* is the power which keeps them going—not the oil under the floor under her feet, the oil that would then become primeval ooze again—not the steel cylinders that would become stains of rust on the walls of the caves of shivering savages—the power of a living mind—the power of thought and choice and purpose."

We hold the awesome responsibility and challenge of "nurturing the power of a living mind."

Some Happenings on The Senior High School Front

H. F. McKEE, *Head, Technical Arts Department, New Trier High School, Winnetka, Illinois*

At an industrial arts round table meeting some time ago I heard myself referred to as an old-timer. It has been said that the old-timers resist change.

I sincerely hope this is not true. On the other hand, let us not plunge into changes just for change's sake.

During the 1930's we were told that we must educate for change. If that statement was true then, it certainly is a gross understatement today. And as a result of the changes that have occurred and are now occurring industrial arts is "on the spot." In some areas it is fighting for its very life. Folks are asking questions—searching questions. Can we justify industrial arts as taught in the past? Is it meeting today's needs? We can get a better picture of today's problems in industry through such an article as "Where the Jobs Are" in the January 1965 issue of *Reader's Digest.*

Research can help us to arrive at the solution to some of our problems, but let us not wait for others to make the inquiry for us. We can set up units for investigation in our own schools and classes. Information on research is offered in the 13th *Yearbook of the American Council on Industrial Arts Teacher Education* (1964) and in the *Reports of Science Research Association, Inc.* Another stimulating booklet is *Contemporary Methods of Teaching Industrial Arts,* Bulletin No. 8. It can be obtained for 50¢ from our American Industrial Arts Association office.

Another way to revitalize the field of industrial arts is to consider new teaching devices. The following are such teaching devices being used today: team teaching, TV, closed-circuit TV, teaching machines, teaching with the computer, use of a flexible schedule (this is described in *A New Design for High School Education* by Dr. Robert Bush and Dr. Wright W. Allen), and use of overhead projectors. These have caused some teachers to become alarmed about their positions. On the contrary, these innovations are tools of the good teacher.

The booklet *Contemporary Methods of Teaching Industrial Arts* has several statements worth noting. They stress learning as a continuous and lifelong process. Edgar Dale, in an article titled "Education for Flexibility," has offered some interesting and insight-filled comments. . . .

> "The world of tomorrow needs the flexible man, the intelligently mobile man, the man who can land on his feet when his job becomes technologically obsolescent. To educate for flexibility we must distinguish between training and education. To train is to emphasize fixed responses, to stress immediate goals, which often have a low ceiling in terms of possible growth. To educate, however, is to foster limitless growth, lifelong learning."

John W. Gardner brought out this point:

> "If we indoctrinate young people in an elaborate set of fixed beliefs, we are insuring their early obsolescence. The alternative is to develop skills and habits of mind which will be the instruments of continuous change and growth on the part of the individual. Then we will have fashioned a system that provides for its own continuous renewal."

The view of learning expressed by these two writers is shared by the members of our industrial arts department. We like to see a student in our classes develop skills and interests which will be with him for a lifetime.

Because the industrial arts program lends itself to individual projects, we see great possibilities in a program that offers opportunity for independent study. Dr. Don Maley of the University of Maryland has been for a number of years encouraging the establishment of classes in research and independent study. If such classes are organized, the question arises, "Will they or do they work?"

Opinions on the worth of such programs are divided. In the September 1964 issue of *School Management Magazine* there is an article, "Independent Study, Effective Program or Waste of Time?" by Don J. Marquette. This article states, "Many independent programs are actually a farce. Few students know how to participate effectively, many never get the chance. Here's a report from Valhalla, N.Y., on an independent study program that works—because it is directed." The programs at Silver Spring, Maryland, and Valhalla, N.Y., prove that such programs can and do work.

Our own experience with students has convinced us that independent study deserves further trial. Some time ago two boys came to us asking that they be permitted to build a laser beam. This involved advanced machine shop work, and they had had no experience at all in machine shop. My first reaction to this request was a flat *no*. Then, for a number of reasons we decided to try the idea. Both boys were high caliber, capable students. In short, we found that with a minimum of explanation and experience they were able to do the work necessary to complete the project.

Without question the capable student can profit from classes in research and independent study. A big question in our minds is how far can we go down the ability scale and still achieve a reasonable degree of success. I want to think and am inclined to believe that the slightly below-average boy who has a *real interest* in some area can, *with the right kind of supervision*, achieve a reasonable degree of success.

The proposal for independent studies that follows may have many faults, but I do believe that it can serve as a starting point. Such a program can be limited to the industrial arts departments, or it can involve the entire school.

The teachers of our industrial arts department believe that self-instruction, self-motivation, and independent inquiry should be encouraged and fostered through a program of independent study. In most boys and girls there is a prodigious amount of legitimate curiosity and interest, a vast reservoir of energy that can be used to explore or experiment with the everyday things around us, the things we take for granted, the unusual, the unknown. A substantial number of young people, if provided with the opportunity, the facilities, resource materials, and guidance and direction, would absolutely amaze us with the depth of their study and accomplishments.

In spite of the exceptional job done by the various departments of the school we feel that there is much talent and ability which is not tapped, or at least not until college or industry gets hold of the boy or girl. We wish to provide opportunities (1) to experiment in unstructured educational pursuits; (2) to stimulate capable students to venture out on their own; (3) to broaden and maximize the use of the school's facilities and personnel in a manner which will enable them to be more productive.

A description of the plan follows: Committee A—composed of interested department heads or teachers—is set up by the administration of the school. The student who wishes to study independently is referred to this committee by any adviser, teacher, or administrator. The pupil presents in writing the "brain storm" he wishes to pursue. His or her idea should have crystallized to the point where the presentation will enable committee A to determine the merits of the proposed study. The committee will consider whether information on his subject is available, whether his interest lies within the province of the school, and what equipment and expense might be involved. Committee A, when satisfied that the pupil's interest can be pursued with profit, refers the student to the department or departments where he will conduct his study. A small committee B, representing each of the departments involved, then requires the pupil to write up a definite procedure which he will follow using a scientific approach to his problem. Because the approach to any problem will to a considerable degree be determined by the very nature of the problem, this procedure may be revised as a problem progresses.

The student will use his study halls or after-school time to pursue the subject, and seminars are conducted on a weekly, semiweekly, or biweekly basis, the need at any given time will determine which. An independent study may continue for a month, semester, year, or more if it is profitable.

We hope that most pupils will show interest and enroll during the first two or three weeks of a semester. However, if a pupil's interest is aroused anytime during the semester or year, he should be able to start his study when he feels the need for it. This interest may well grow out of an assignment in any class in the school for independent reading.

Credits allowed are based on the evaluation of committee B with which the student has worked. The student will present oral and written reports of his findings. The results may be concrete or intangible. Credits will be based on time spent on the study and the degree of accomplishment. Credits in independent study will be allowed in the department in which the study is made, or they will be divided between two or three departments if necessary.

Equipment anyplace in the entire school is available to the student under proper supervision and direction. The department head has the final say in all such matters.

Where ability necessary to construct needed parts or apparatus cannot be acquired in a reasonable time, the instructor may supply the needed skill, or a commercial firm may have to be paid to do some of the work. Also, a commercial product or part may be available.

Similar studies have proved themselves in business, industry, and higher education.

It does not appear likely that a pupil who is less than very serious will be approved by both committee A and committee B. We certainly do not think of this program as a toy, gimmick or catch-all. It is not fair to teachers to ask them to spend time on something of this nature if the pupil were not in dead earnest.

Credit for this study may not be necessary if proper mention is made of it on the college transcript. It may help a pupil to be accepted at the college of his choice. We have talked with a number of people about this matter of credits. The pressure for grades and credits is so great that we may find it necessary and desirable to give credits, at least until we determine the probability of success or failure of this venture. The consensus of opinion has been that credits should be given, not grades. The matter of credits needs additional study.

There are countless resource persons and materials in the Chicago area. The contacts these students have through parents, relatives, and friends are tremendous. When contacted by phone or personal interview, most prominent companies or corporations, we believe, are pleased to cooperate with high school students on worthwhile studies and ideas. It is our hope that many of these studies will require knowledge far beyond the limitations of most of our teachers.

We believe that honest suggestions and criticisms of this proposal will go a long way to iron out possible problems that exist or may arise.

A pilot study will be conducted among two or three departments so that the proposed procedure can be scrutinized and evaluated. The realization of our goals and objectives means work and lots of it. Truly, "Success was never purchased at the bargain counter."

Symposium—Significance of Developing Creativity As an Important Aspect of Concern for the Individual

Creative Teaching Means Time to Create

STERLING PETERSON, *Resource Teacher in Industrial Arts, Minneapolis Public Schools, Minneapolis, Minnesota*

ARTHUR Brisbane, a syndicated columnist over many years, stated that the greatest loss to the human race has not been caused by floods, fires, epidemics, earthquakes and tropical storms, crashes on Wall Street, or world wars—the greatest loss has been in *buried talents.*

We all have talents and thus we are all creative. Up until recent years, it was commonly thought that only the highly intelligent were creative. According to Elliot W. Eisner in his article, "Research in Creativity: Some Findings and Conceptions," in *Childhood Education,* April 1963, intelligence is not a reliable predictor of creativity, for if scores on intelligence tests were used to identify the highly creative, about 70 per cent of the most highly creative would be missed!

Maybe we, as industrial arts teachers, have thought that many of the students we have do not possess creative talents and have done very little to develop them. As a result, these talents have been buried with scores of others, contributing to the world's greatest loss. To develop these talents we, as teachers, must be creative teachers. Creative teaching will mean *time to create.*

Let me describe two creative teachers. Then we will determine what they have in common and why this allows them time to create.

Mr. Joslin is a person with boundless enthusiasm. His classroom is a treasure house of fascinating displays. He joins in with his students as a learning partner. His students are encouraged to create and express ideas.

Mr. Harris recognizes the positive qualities in each of his pupils, the dull as well as the bright. When he wants to display projects, he makes sure that every member of the class has something to display. For him this is not a reward, but a motivation for all pupils who can proudly claim their own achievement. He is always innovating ways to enrich learning and to motivate the pupils to further achievement, and his own motivation for further learning is infectious.

Common characteristics possessed by these and other creative teachers include *sensitivity toward each child;* they are resourceful and adventurous, flexible, willing to get off the beaten track, will tackle difficult tasks, are likely to make a few mistakes. They may even seem to be a little antisocial, a little impatient with the process of education and feel that it is "out of step"; their class rooms are treasure houses with many fascinating displays to encourage learning; they see the knowledge of the past as mere tools to be used to create. They are self-sufficient, willing to let an unsolved problem "hang in the air" for a time, willing to let students make mistakes and still be considered of worth as persons, and make students feel they belong to a group.

Because a teacher possesses these characteristics, he will be creative and will create. A few of the techniques used by a creative teacher are as follows:

1. Set the stage for creativity. This means the teacher will be explicit in defining the problem which the student is attempting to solve. He will arrange his room so that it is conducive to creativity; it should not be drab, unkempt or sloppy. The materials needed will be provided. We as teachers must then let the *student create.* Are we guilty of preventing our students from using their talents because we say everyone has to do it this way, or we don't allow enough time to create?

I wonder if our students have ever felt like the great Michaelangelo when he once stood outside of a house looking through a window into a room where a canvas was stretched upon an easel; the paints and brushes were neatly arranged. They were just sitting there waiting for someone to use them. As Michaelangelo stood there looking he exclaimed, "If I were only inside, what a picture I could paint!" Don't you suppose the industrial arts student feels the same way when he looks into a neat, attractive shop with all of its exciting equipment? Do we put the damper on their desire to create?

2. A creative teacher must assign problems to be solved creatively well in advance of their due date. This will allow the student time to let ideas grow. The growth of ideas can be accomplished by talking to experts, cutting out clippings on the topic, keeping a card file from various books and publications on the topic.

3. The creative teacher may have students change existing designs. The best source of designs that I can think of are the various catalogues, for instance, Sears-Roebuck's.

According to Jerome Moss and David Borkquist in their article, "What Is Creativity in Industrial Arts?" *Journal of Industrial Arts Education,* January-February 1965, there are three types of creativity. They are: behavioral—change in behavior; symbolic—improving the aesthetic qualities of a product; figural—arranging objects.

An example of behavioral creativity is the learning of our free enterprise system. In order for students to understand our free enterprise system, they must experience the organizing of a company, financing of a company, making production plans, keeping records, selling the product, and liquidating a company. This type of creativity would be behavioral; the actual production of the product on the assembly line is a figural type of creativity.

Another type of creativity brought about by the creative teacher is the Plymouth trouble-shooting contest. In this activity students manipulate objects, solving malfunction built into an automobile. This is an example of figural type of creativity.

The creative teacher may ask a student to design a lakeshore home for himself or another person. This type of creativity is an example of symbolic creativity.

Students having these experiences did not bury their talents but were creative. This resulted from a creative teacher who, because he was creative, took time to create.

Exploration and Experimentation In Industrial Arts

LEE H. SMALLEY, *Division Head, Wheaton High Schools, Wheaton, Illinois*

CREATIVITY is an important aspect to develop in the individual. Now if we could only agree on a definition of creativity. If we could only find some experiences that could change student's behavior to being more creative, and then develop some evaluation instruments to measure the extent of the change.

The magic word I have been given is *experimentation.* What I am going to try to do is to see what the significance would be if we took seriously the charge that creativity is an important aspect to develop in the individual, through the magic word of experimentation.

Those of you who are familiar with the dramatic change in the content and teaching of B.S.C.S. Biology will recognize that experimentation is the central theme in this change. We would not want to hide this part of our curriculum. It must be made visible. It must be recognizable by students, teachers, parents, colleges, principals, guidance counselors, and employers: they will have to see it to believe it. There is too much publicity value, too much prestige, too much education for this to be fragmented and kept as an insignificant position in our curriculum. *My suggestion would be to make a semester course of experimentation.* If we would pair this with a semester of mass production, we would really have a winner, but the magic word now is *experimentation.*

I will not detail the scope, sequence, or techniques that could be used in such a course. This has been done before in our literature, and I hope will continue. I will detail some of the other items so that a better understanding of the proposition may be reached.

1. **Grade Level.** This should not be a beginning or a culminating activity, so this would leave the 10th or 11th grade available.

2. **Prerequisites.** At least one year of industrial arts, art, or a physical science. This should insure a variety of interests, competencies, and skills.

3. **Facilities.** There would need to be little change in facilities to implement a semester course in experimentation. In fact the smaller schools would be in a better position, because of their general shop, to provide some leadership. Test equipment can be constructed, borrowed or purchased over a period of time.

4. **People and Organizations.** Now, what do people and organizations have to do in order to make such a course successful? **AIAA** would have to publish materials and provide a clearing house for leadership to emerge. **Colleges** would have to include this in their curriculum. **ACIATE** would have to organize workshops and provide leadership. **Supervisors** would have to sponsor in-service training sessions. **Industrial arts teachers** would have to accept this as a challenge. **Principals** would have to encourage their reluctant teachers and not set up road blocks for others. **Students** would have to elect this course. **Guidance counselors** would have to encourage and sign students up. **Parents** would have to give their approval. **Industry** would have to make available material, literature, and personnel.

So you see, like the successful politician, there is something here for everyone, except rather than promises of something free, this would only promise work and a need for some changes in values for people. I don't know if this is where we might want to make a stand; but as with an army or a group not really tested yet, the AIAA, its affiliates, and the whole body of industrial arts teachers will need to make a trial run, to flex its muscles, to gauge its strength, to embark on a pilot project on a national scale, to see if there is any possibility for a consensus of unanimity on what constitutes an industrial arts curriculum.

Let us return to the symposium topic, what is the significance of developing creativity as an important aspect of concern for the individual? I would propose the following significant developments if a course of action were implemented as I have just outlined.

1. Students would be exposed to some educational experiences that would seem to be beneficial;
2. Industrial arts teachers would have shown the discipline necessary to get a consensus and implement it;
3. This course would provide an example of how industrial arts is a part of general education;
4. This course would account for individual differences;
5. This course would dispel the "dumping ground" concept;
6. This course would have to have some concern for technology;
7. This course would provide a need for some programed instruction.

You may supply other phrases or magic words as you wish, but I believe that if this were attempted on a national scale, some hard questions could be answered about the future of industrial arts in public education. No smaller role should be assigned to this phrase, creativity is an important aspect to develop in the individual, or to the magic word, experimentation.

The Nature of Creative Behavior In Industrial Arts

JAMES E. SEITZ, *Assistant Professor, Department of Industrial Education and Art, Kansas State College, Pittsburg, Kansas*

CREATIVE ability has become highly valued. Last year, the employees of a large corporation were paid eight million dollars for constructive suggestions. One worker, a 17-year man, earned a total of $46,000 for his ideas.

Such figures are rather impressive, but they do not provide a complete picture of the importance placed on creative behavior throughout industry. Since the late 1930's when General Electric started its creative engineering course and Alex Osborn initiated the brainstorming technique in advertising, scores of companies have developed programs of their own. Named among the published lists are the nation's ten largest corporations. The benefits reported by different companies, in terms of increased production of ideas and inventions, are too numerous to mention.

The fact that industry is so strongly involved in this phase of education leads us to certain conclusions: (1) Creative thinking and creative problem-solving can be taught when a deliberate effort is made to do so, and (2) the schools have not been doing the job adequately by traditional methods. Yet, creative education is the legitimate duty of the schools. Industry recognizes this. It continues to finance a foundation to help make creative techniques a regular part of formal education.

What is our position in indusrial arts in this matter? The answer is all too familiar: Once again we are far behind industry. What we have done to date must be described as largely incidental to other outcomes. We might be doing more, for research studies indicate creative ability can be nearly doubled by developing a creative classroom atmosphere. If we, in industrial arts, are to develop the individual's potential fully, we must dispense with some of the stereotyped procedures which tend to dominate our curricula.

In order to clarify that premise, I'll first attempt to present a workable definition of creativity. Von Fange, in his book *Professional Creativity,* says, "To create is to combine existing elements in new ways, even if new only as far as the creator himself is concerned." The resulting product must not necessarily be something tangible, but it must have some recognizable worth. Thus, for a product to be classified creative, two conditions must be satisfied. They are originality and usefulness or, if you prefer, uniqueness and value.

By way of illustrating creative behavior, allow me to share an experience which occurred some years ago. This was the situation: In a small plant shortly after World War II, a reflective product was being developed for use on license plates, highway signs, and medial strips. The reflective property was provided by means of minute glass spheres imbedded in the surface of pigment. Only the perfect spheres were found to reflect light effectively. Thus, a shipment of the glass beads could be used only if it contained a small percentage of flat-sided beads. To determine if a shipment was acceptable, at that time, technicians painstakingly separated a sample using tweezers and microscope and then made a quantitative comparison by weighing the resulting parts.

This, then, was the problem: How could the sample of beads be investigated more economically? One creative person came up with the answer. He obtained a square piece of highly polished plate glass, inclined it about a degree, and poured a quantity of the beads near the high end. How simple! The spheres rolled off while the irregular shapes remained to be collected from the surface of the plate. However, the problem was not completely solved. An accurate separation could not be readily obtained; some of the good beads clustered with the flat ones. Our engineering friend then reasoned that by vibrating the plate the clusters would be broken up. He had the answer. One end of the plate was made to pivot about an axis and the other end was made to oscillate through one degree at high frequency. This was done by using an eccentric attached to the shaft of a fractional-horsepower motor. The result was remarkable. The spherical beads rolled freely into a container fixed to the low end, while those with flats "climbed" to the high where they were collected. A complete sample could be separated and weighed in a few minutes, whereas the previous method involved hours of intensive work.

Was that really creative activity? Certainly the end result was beneficial, that is, it was useful, it had value. But what about the other criterion, originality? Of the things involved, not one material, not one mechanical device, not one physical principle was new. Their application was unique. How these things were combined gave rise to originality.

I believe we have persons capable of similar activity in industrial arts. Perhaps there are many more in our classes than generally realized. According to studies, as summarized in *A Source Book for Creative Thinking* by Parnes and Harding, almost everyone has some creative ability, including the first-grader. Those studies also identify the highly creative person. In general, he is a bit introverted, is interested in doing different things, but is not necessarily the most intelligent of a particular group. Quite often he comes up with ideas which, to less creative persons, seem to be "wild" or unworkable. He may even be disliked by his peers.

It is encouraging to find that the tests for identifying creative persons and measuring creative ability are now being adapted to industrial arts. In this age of rapid technological change, it is becoming increasingly important for us to nurture these abilities. Industry has developed the techniques; we must do more to learn them. We must provide the student with better opportunities for exercising his imagination and power of thinking—let the students originate ideas, plan procedures, and test their validity. We can well afford to cut down the time required of the student to do hand-sanding, filing, and polishing in favor of a different emphasis. There is significance in noting, in this connection, the creative worth of a project is determined on the basis of the underlying idea, not the quality of workmanship.

Considering the unique nature of the industrial arts program, with the possibilities it provides for putting classroom theory directly to test in the shops, I believe our greatest opportunity for developing creative behavior remains in the area of design. Inherently, both *creativity* and *design* are associated with ideas. However, if we ever expect to open this area for the students' full expression, we must come to an understanding that design is something more than art. The design of any structure and every machine involves at least one of two principles—the principles of force and motion. How the application of these principles has been avoided so generally throughout a program which purports to study the methods of industry is difficult to understand. And, I know for a fact the basic equations or design are not beyond the comprehension of the high school industrial arts student.

If, in introducing this topic, I have put my neck out, so be it. I would recommend something similar for all of industrial arts, for I am reminded of a story told about Dr. James B. Conant. While president of Harvard, Dr. Conant kept a picture of a turtle in his office. The caption read: "Behold the turtle. He only makes progress with his neck out."

Symposium—The Effect of Environment on the Human Potential

What Is the Nature of the Social Setting in Which the Individual Learner Will Be Free to Test His Own Powers, Offer Tentative Findings or Conclusions, And Be Motivated to Pursue New Investigations?

CHRIS H. GRONEMAN, *Head, Industrial Education, Texas A & M University, College Station, Texas*

FOR the sake of brevity and clarity I have broken up this somewhat lengthy title into three subdivisions: (1) The nature of the social setting, (2) testing the individual's powers, and (3) motivation to pursue new investigations.

Today words still count. They are communication. The most significant aspect of human behavior may be the use of words. Verbal communication in the classroom, laboratory, and shop is basic.

Communication is defined by the Latin roots as carrying the significations of (a) dividing and sharing, (b) making common to many, and (c) imparting. The current meaning includes (a) to transmit, (b) to impart information, and (c) to share and enjoy in common.

Communication deals with the *process*, the *message*, and the *effect*. Communication involves the reciprocal interactions of sending and receiving signals; of composing and understanding messages; and of sharing and enjoying ideas.

These three interactions are likened to interrelated stages involving areas of engineering or industrial psychology, and sociology. The engineering or industrial aspect deals with the means by which signs are sent and received. Psychological emphases are concerned with acquisition of language and its variety of meanings. The social level deals with consequences of interchanges of communication.

Good communication rewards teachers and students alike with enlarged *comprehension, pleasure,* and *action.*

The second subdivision is considering how to test one's powers.

The concept of *set* is as important in psychology as it is in modern mathematics. According to M. C. Wittrock of the University of California at Los Angeles, *set* will probably attract more attention in education in the future than it has in the past.

Faced with particular laboratory situations and problems, we are predisposed to respond in particular ways. *Set* surely influences the choices we make. It has been suggested that a problem sometimes remains a problem *only as long* as we keep the wrong set.

Wittrock's investigation reported that the student teacher may try to reconstruct imaginatively how he might have behaved if he were one of the students in the experimental group. He would think about how his motives and efforts would have been influenced by set.

Another educator suggested that the *motivational problem* in education might finally boil down simply to obtaining students' attention . . . then *properly directing it.* We ask ourselves how this recent concept actually differs from the good old horse sense we have been using all this time!

Set is used to increase the probability of the occurrence of certain responses, and to decrease the probability of occurrence of other ones. There are "motor" and "goal" sets. Between these two extremes are *learning, response,* and *task sets.* One method of developing set in subjects is to reinforce trial-and-error situations to allow the subjects to *discover* when certain sets are appropriate.

The third subdivision is the consideration of motivation to pursue new investigations. It is interesting to note that *learning cannot be sufficiently motivated without anxiety.* The job of the teacher is not to remove anxiety from the learning situation. Rather, he must regulate the motivational level so that there is neither too much nor too little.

The ultimate test of efficient learning in the laboratory or classroom is always some future performance of the student. Psychologically this is the question of remembering and transfer, or the use of learning under appropriate conditions.

Advocates of the process of learning by *directed discovery* claim these advantages: (1) It increases the learner's ability to learn related material; (2) it fosters an interest in the activity itself; (3) it develops ability to approach problems in a way that will more likely lead to a solution; and (4) it tends to make the material that is learned easier to recall or reconstruct.

Dr. Bert Y. Kersh, director of teaching research, Oregon State System of Higher Education, in 1958 conducted experiments in learning. Results showed that a directed group in which the group received an intermediate amount of guidance was superior in learning rate and immediate recall.

A "no help" group was superior in terms of *retention and transfer* after a period of approximately one month following the learning period. It would seem a good policy for us, as teachers, to encourage students to "do it themselves" . . . thus feeling the pride of discovery and initiative. The "no help" group was motivated to continue the learning process because of the individual achievement, and the continued practicing of the task after the formal learning period. It is a good example of industrial knowledges and skills being continued all through adult life.

The social climate or environment should be one of cooperation, challenge, and, strangely enough, anxiety. A person does that which he must, and, if sufficiently challenged, he can and will produce and be proud of his accomplishments.

The old saying, "Virtue is its own reward," seems to be more modern than we realize, for if the experiments of Willrock are valid, then we realize that the fact of doing the act well is in itself sufficient reward.

Just as young people *want* to be disciplined by their parents in order to feel secured and loved . . . just so the teacher *must* challenge the student and demand more than he thinks he can do!

In What Kind of Setting Will the Individual Be Most Likely to Realize His Full Potential?

HOWARD H. GERRISH, *Associate Professor of Industrial Arts, San Jose State College, San Jose, California.*

I believe that the committee on program selection for this national convention was truly sensitive to the needs of youth and education, and the myriad of perplexing problems confronting the philosopher, the administrator and the teacher. A symposium on "The Effectiveness of Environment on the Human Potential" suggests a signal awareness of the problems. The effectiveness of modern education may well be evaluated in future years by the survival of the democratic way of life. Personally, I approach this topic of discussion with a feeling of inadequacy.

I recall from past experience a young lady named Cindy, above average in ability in her school work, but with a gift from God to appreciate music. In the vernacular we would call her a "born musician." She was in the ninth grade. Her parents were financially able to employ private music teachers. Both a fine Steinway and a Hammond organ were provided to encourage her talent. Remarkable musical progress was made until the school counsellors decided that Cindy would realize her full potential by attending accelerated classes in mathematics and science. She did well and justified the counsellor's decision, but the additional homework assignments left no time for music. Cindy is now married after two years of college education and seems to have little interest in music. I question whether she has reached her full potential.

One year I took Tom, along with several other boys, on a radio field day. Here was a boy who had built his own radio transmitter in the seventh grade; who had acquired a chemistry laboratory in the basement of his home, better than many high school laboratories; who had studied qualitive and quantitative analysis as most boys read Popular Science. He was an "egg head" in math. Parental guidance and social pressures sent him to a prestige liberal arts college to major in literature and social sciences. Tom did not fail—he would do well at any school—but his interests, his motivation, and his academic vitality have temporarily been sacrificed on the altar of poor counselling.

Each of you can add similar stories from your experiences. Thinking positively, I suggest that these cases of misdirection and poor advisement are exceptions rather than the rule in our schools. There is sufficient evidence for an indictment at least, that many of us regard brilliance, genius, extreme interest and motivation as the deviate behavior, rather than an acceptable predictor of social and scholastic achievement.

Scholars in the field of the behavioral sciences propose many laundry lists of environmental influences upon a child's growth and eventual realization of his potentials. Volumes have been written identifying child needs and how they may best be met by our schools. Recognition of these needs is certainly the task of the parent, the teacher, the family and the school. This may be redundant but the evidence seems overwhelming, that we teach subject matter oriented courses with continuing emphasis on the assimilation of facts and figures with meager and infrequent opportunities for applications of underlying concepts, originality, creativity and individuality. Even personality development carries the stigma of an objective of the "progressive educator."

Dr. Sidney Hook, in his book *Education for Modern Man,* states "A school nas the responsibility to create special opportunities for further study commensurate with the students' talents and interests." What then are some of the environmental circumstances and personal influences which we can exert to create an atmosphere in which a child might realize his full potential?

The universal curriculum has been mentioned as a contributing deterrent to the development of a creative and individual personality. This statement should be tempered somewhat. There is a group of skills which all students should attain for intelligent participation in the social life of a democracy. All students should be well informed on certain subjects and should acquire habits of responsible action. And quoting from *Education for Modern Man* again, "A child cannot assume total responsibility for the decision as to what constitutes his educational needs until maturity is reached."

Yet a child, to realize his potential, must learn to make his own decisions. He must have an opportunity to develop autonomy. The continual conflict between teen-agers and parental authority is evidenced everywhere and takes the form of deviate behavior and dress, gangs and demonstrations, defiance of authority and frequently delinquency. The converse of this is equally objectionable. The "mother hen" attitude of some parents, the "father knows best" cliché, the "do as teacher says" formula for academic success, take their daily toll by inhibiting personal realization.

A child must have opportunity for success and recognition by his peer group. We all live for a little self-satisfaction and recognition. This alone can be the greatest driving force in the realization of individual potential. There are thousands of youth among our unemployed who have never had a chance to be right or even partially successful at anything. Conversely, a child can be presented with insurmountable obstacles and encouraged to meet them with abject failure as a result. This is an admonition to many doting parents, who discover too late that their ambitions for their "presidential timber" son should have been directed toward the plumbing trade. Now they have a failure, a college drop-out, a frustrated boy, poorly employed and dissatisfied with his lot in life.

A year ago I bought a small plant for my wife. She is an ardent gardener. The nurseryman extolled the virtues of this plant and guaranteed that within a year it would grow to two feet in height in the California sunshine. The year ended last month and I measured the height of the plant and found it to be only eighteen inches. Knowing that it should be 24 inches, I reached down and pulled it up to 24 inches. The plant died. This lesson in horticulture applies equally well to some of our children when we try to push them too far beyond their abilities.

Finally, the environment which teaches, by influence or interaction, the immeasurable values of knowledge and learning will be most effective for potential growth. Not only should the value of education be sold on economics and the increased take-home pay of the college graduate, but also that our continued success as a nation depends upon a well-informed people, skilled not only in occupational endeavors, but skilled also in social competencies and sensitive to the moral responsibilities of work.

As a summary, my experience and studies seem to indicate that the setting in which a student will be most likely to realize his full potential must include: (1) An environment influenced by people who recognize the problem with a sensitivity and sincerity to continue their efforts towards adequate solutions. (2) An environment concerned with improved and intelligent guidance techniques for our youth. (3) An environment which recognizes individual differences, negates the universal curriculum, and replaces it with a curriculum which reflects the needs of individuals. (4) An environment which encourages a child to make decisions, one which stimulates his curiosity and provides the means to satisfy his curiosity. (5) An environment which teaches the dignity of work, the value of self-esteem and the occupational and cultural advantages of education and learning.

What Will the School Be Like That Best Releases and Develops the Positive Potential of the Individual Learner Through Appropriate Content and Experiences Which Have Personal Relevance for Him?

IRVING W. HERRICK, *Maryland State Supervisor, Industrial Arts Education, Baltimore, Maryland*

PETER Drucker, writing in the February 1965 issue of *Harper's Magazine* on the topic, "American Directions: A Forecast," suggests that in the not-too-distant future, "our society will be school-centered." He goes on to state that, "All we have so far—and it is a great deal—is a national commitment to education in quantity, and for everyone." I should like to agree with Mr. Drucker's remarks and hastily add that the school that best releases and develops the positive potential of the individual learner must not stop at quantity but must commit itself as well to quality education.

A machinist who has worked in a production shop or operated a bank of automatic screw machines would tell you that the production of quantity is easily accomplished. He would tell you also that it is as easy to produce a hundred misfits as it is to produce a hundred near-perfect parts. Speak to an experimental machinist at NASA, Boeing, or Glenn L. Martin, however, and he will assure you that custom production is a demanding and painstaking task, particularly when decisions pertaining to design, dimension, form, and function must be constantly made at each step along the way. Custom production starts with a basic idea and proceeds slowly with much hesitation, backtracking, and quite frequently the abandonment of entire methods of procedure.

The ideal school of tomorrow may be likened unto an industry specializing in custom production. The teacher will be the experimental machinist and the school philosophy will be the basic idea with which he works. The course objectives will comprise the product design; the basic learnings, the dimensions of the finished workpiece; and the educational experiences, the cutting tools of production.

With this analogy in mind let us proceed to examine the internal operation of the abstract ideal school, the actual process of custom-producing citizens if you will. None of the components of this process are new, they may even be banal or jejune to some, but I assure you that they can be full of life and that their usefulness is not extinct. In fact, if the enlightened educational environment which my colleagues have so eloquently described is to function effectively, or even come into being, it is essential that these components be present and operative. For it is these elements which in the long run dictate what that environment will be.

Contemporary Philosophy

The school that best releases and develops individual potential will take into account the distinguishing features of the age and the culture. It will consider and account for all types of learners, their persistent needs, and their fullest potential. The philosophy of the ideal school will leave no stone unturned, will leave nothing to chance in describing the role which it is to play in the production of citizens and neighbors. The contemporary philosophy of the ideal school will provide a foundation for the establishment of an educational environment conducive to learning.

Behavioral Objectives and Basic Learnings

The pervasive goals, purposes, or objectives of the school flow readily from a well-developed philosophy of education and are easily expressed in behavioristic terms. In the ideal school, however, the pervasive goals will be rewritten in terms of each individual student with every consideration given to his particular needs. Thus, the objectives will become the student's property and he will use them in selecting needed learnings and hence learning experiences.

Godfrey Stephens (1958) has presented the following statements to be used in selecting and evaluating specific goals. He was writing about the selection of goals for retarded pupils, but his points are equally applicable to the education of all.

a. The nature of the learner and the nature of the society in which he lives are an effective basis for the development of specific goals.

b. The interaction between the learner and his culture is the basis for an infinite variety of complex problems of adjustment that can serve as a basis for the development of statements of goals.

c. The interaction between the learner and his physical environment with its associated constellations of problems can be stated in terms of persistent life situations.

d. The persisting life situations can be converted to educational experiences that are as dynamic as the environment from which they arise.

Time does not permit the complete presentation of Stephens's thesis but this portion supplies the background for concluding that an analysis of persistent life situations provides for a systematic development of behavioral objectives. When student and teacher alike know and understand what is being sought as an end result, an evaluation of the current situation will reveal deficiencies in learning. These deficiencies may then be met head on with full appreciation of what is to be gained through study. Frequent evaluation along the way will permit the restatement of objectives and the selection of new or different learnings.

Learning Experiences

In his text, *Basic Concepts of Teaching,* Asahel D. Woodruff (1962) makes the point that "All the many things involved in teaching are just parts of three major elements: Something to be learned, the action by which the student learns it, and the degree of the student's receptivity for the learning experience."

It is in the action, the learning experience, that the ideal school and its environment can best accomplish the release of positive individual potential. The determination of what is to be learned will be accomplished by the procedure previously outlined and the degree of the student receptivity will be greatly enhanced by the positive learning environment.

The literature is replete with utterances to the effect that learning proceeds best when the student is directly involved. An example is this statement by A. Gordon Melvin (1952) in his book, *General Methods of Teaching:*

"Subject matter is practically always in the wrong form for teaching and learning. It must be recast, reorganized, by learners. Consequently, the teacher is absolutely compelled to forget ideas, knowledge, and information, and persuade his pupils to do something. This is the key to method. The teacher must somehow prevail upon his pupils to act. It is pupil acting that will recast the subject matter and give it new life."

The vast importance of this type of learning is emphasized by Snygg and Combs (1949), who write:

". . . Students who are taught by verbal means alone are sure to behave as if most of the material they study is without relation to themselves, as indeed it is, until they actually experience the situations the books and teachers are talking about.

"In general, the problem of communicating meanings is so difficult that it is often much more practical to help students discover the meaning of objects and events by actual experience than to try to convey them verbally. Furthermore the meanings are bound to differ from one person to another because the object or event will play different roles in different fields. It will have different potentialities for different people."

A fitting summary to this section is the classic quote from Alfred North Whitehead (1929) to the effect that "The pupils have got to be made to feel that they are studying something, and are not merely executing intellectual minuets."

Evaluation and Revision

When the school is abstractly described in terms of the free-flowing process of custom production, then the release and development of positive potential appears vastly simplified. There is, however, one further major component to the process that needs to be discussed. That component is the quality control function which provides for the continual inspection and revision of all operations. Without this, any process soon becomes ineffectual as tiny errors multiply and cause great discrepancy in the finished product. Likewise, if the school is to maintain quality, the entire program and each minute part must be under constant scrutiny and constant revitalization.

The evaluation of the school cannot be haphazard and also effectual. The process must be built in from the beginning and followed through to the continual revision of curricula and programs.

I would close with a quote from the February issue of *The Bulletin of the National Association of Secondary-School Principals* which was devoted to "The Coming Crisis in Secondary Education" (Kraft, 1965).

"In American of the 60's . . . it is clear beyond question that there is no such thing as a free market for regulating and promoting the deepest human *needs* of youth, and that without considered planning on the part of those who are competent to plan we face disastrous social failures."

Here, then, is your environment, gentlemen, do with it what you will!

What Resources Are Necessary or Desirable to Insure to The Learner New Vistas, New Mastery, and New Avenues of Growth?

G. WESLEY KETCHAM, *Consultant in Industrial Arts, Connecticut State Department of Education, Hartford, Connecticut*

It has been said that industrial arts is recognized as that part of a total educational program for all youth concerned with the development of a practical understanding and appreciation of today's industrial and technical society.

Unfortunately, few people outside the field of industrial arts believe this and too many people within the field are still offering traditional teacher-centered experiences and content which do anything but show concern for the individual and his potential.

To be recognized as a part of the total educational program, it is vital that it also be understood that industrial arts is but one of many curriculum areas which can offer opportunities for human development and growth. To really educate for democracy demands an overwhelming assumption that the human potential must be permitted to develop under environmental conditions which will insure to the learner new vistas, new mastery, and new avenues of growth.

The available resources which will assist and assure the development of such realistic concerns are limited only by the ability of those concerned to recognize them. The use of limited and traditional resources is but a reflection of the static nature of far too many subject-centered industrial arts offerings.

The development of the human potential is dependent upon the permissive nature of the environment in which behavioral change takes place and the importance of such change depends upon the degree to which the individual conceives, interprets and accepts his own beliefs as they relate to sound attitudes, habits and values. It is only through the flexibility of opportunities to use unlimited resources that a realistic approach to the needs of the individual can be met.

There are many ways to classify resource materials but whatever method is used, the availability and logic of application to the problem at hand from the standpoint of the individual should be uppermost. The comprehensiveness of resources will determine its usefulness to the user. It should vary from simple and immediately-revealing types of direct contact and experiences to the more subtle and sometimes abstract material from which the more energetic and sophisticated student must diligently search, examine and extract to meet his needs.

The D-11 form of the 1960 Edition of the Evaluation Criteria of Secondary Schools Evaluation outlines as a part of a check list for *Instructional Materials* the following items which may be regarded as basic resources: Current city, county, or state resource units or teaching guides; up-to-date texts; a variety of selected references; periodicals and pamphlets; descriptive material and commercial products; occupational monographs; posters, charts, graphs and pictures; miniature, cutaway and actual-size projects and devices; and films, filmstrips and slides.

To such a general classification of basics one might add such aids as maps, the chalkboard, models, mock-ups, bulletin boards, radio, TV, recordings, and—*people.* The last one mentioned, people or human resource, is frequently the last one identified and yet it is one of the best and most fruitful.

The realities of person-to-person contact will represent, for most individuals, the finest and most meaningful type of resource. The wise teacher will encourage the development of a file or list of potential human resources. The individuals within a class or group represent initial, identifiable human resources. Each has a unique background of experiences, environment and individual concerns and each as a peer represents a personal contact which has real meaning for the better.

Certainly from early childhood each individual has unconsciously used the most personal of contacts—the mother, the father, and other relatives generally associated with affection and admiration. Within the school itself, the human chain of contacts is almost endless and might well run the gamut from school custodian to the superintendent of schools. Certainly all teachers, the school nurse and especially the library teacher represent untapped resources of information and guidance.

One of the finest means of adding depth and understanding to any individual's problem is to tap the rich human resources of a community. A survey of the human potentials in any community will immediately identify the resource personnel who can really provide new vistas, new mastery and new avenues of growth.

Just think of your own community and the talents available for the asking: the people in the arts, the craftsmen, the skilled tradesman, the scientist, the business man, the plant manager, the public officer, the librarian, the mechanic, the architect and on and on—try it—just begin listing people and their professions, their occupations, their hobbies and their talents—such a list can well represent the most valuable resource available to you and your students. The new vistas and avenues are there if one will but take the time to look.

What School Shop Environment Will Be Conducive to "Openness to Experience" on the Part of Learners?

ELDON W. DANNE, *Head of Industrial Arts Department, Westmar College, LeMars, Iowa*

THIS question will be partially answered by looking at three major factors: (1) Physical; (2) human; and (3) social.

(1) Physical Factors:

Heat. Thermal environment includes heating, ventilation, air movement, air cooling, air cleaning, humidity control, and air freshening. Comfort or discomfort will have a marked effect on the student's learning, physical health and mental welfare in his relation to other students and teachers. Extreme temperature fluctuations should be avoided.

Color. Drab environment is discouraging. Color is inspiring—it affects moods of the learner. Colors should be used which absorb light, reduce glare, and act as a darker background for materials being worked. Eliminate the conflict of stimuli. Frames of machines should be painted in tones of blue-green and dangerous parts either yellow or red. White ceilings, grey floors; walls, one tone of yellow in high places and one tint of blue-green in lower spaces, would add to an over-all pleasing effect.

Sound. An industrial education shop is a place where one expects to hear noises of various kinds. Noise control is difficult to obtain in any shop setting. New acoustical materials, new types of floor coverings, and quieter-running machines hold much promise in lessening the effects of excessive noise.

Light. The amount of daylight (if any is utilized), the type and arrangement of electric lights, illumination level, brightness and glare, are all to be considered in proper lighting for the shop. Visual environment to learning processes is poorly understood. However, the comfort of a visual environment is important and providing it in the lighting of schools is a big step in the right direction. Arrangement of equipment also may help learning processes.

(2) Human Factors:

Teacher. Some excellent learning situations have been developed in industrial education shops with rather modest furnishings and equipment, but only where the teacher and learners have created an environment that has meaning to them. In these cases the human factor of the teacher has created a good teaching-learning environment that has been able to overcome the undesirable aspects of modest physical facilities.

A teacher who has unusually fine rapport with students probably has the following characteristics: An earnest concern for all students; a strong feeling of professional obligation for knowing much about all students; a habit of keeping records about each student; a desire to become acquainted with parents; a sincere liking for all youth; good self-discipline; an endeavor to constantly study human behavior so that causes for tensions may be understood; a vital interest in research; a philosophy that pupils should be happy as well as successful.

A successful teacher must know subject matter, like to be with young people and have a pleasant personality. More teachers lose their jobs because of their personalities than for the other two aforementioned factors.

Students. Students who may measure as only average in verbal and numerical abilities may be superior in mechanical aptitude. They may develop into fine craftsmen.

The following classification of students, according to ability and achievement, may serve to identify the most usual types of students in the classroom:

1. A superior person who recognizes his talents and achieves.
2. A superior person who does not recognize his talent and underachieves.
3. A superior person in academic areas but much less successful in specialized areas.
4. A student with great industry who overachieves.
5. An average student who achieves at an average rate.

6. An average student who, though very bright, is handicapped by deficiencies in the tools of learning and emotional stability.

7. A low achiever in academic areas who performs well in some specialized areas.

8. A slow learner in most or all types of learning situations.

It is now necessary to have the school follow educational programing practices which facilitate optional development of all pupils with regard to his aptitudes, interests, achievements and opportunities.

(3) Social Factors:

How do students react to one another? Some are more popular than others and can exercise more influence. Encourage the more popular ones but also recognize latent abilities of the less popular ones and encourage them to use their abilities as well.

How do students react to the teacher? As soon as a teacher relaxes his control on the class, disorder breaks out. Because such behavior demonstrates the group's feelings of solidarity, students are motivated to move with the group against the teacher.

If you as a teacher are able to create a more favorable attitude toward the students' abilities, this will, in turn, give you the success experiences necessary to enhance your feelings about your own worth, which will stimulate you to increase efforts in teaching.

The industrial education teacher must dress, speak and write as well and be as fully informed as any other teacher if he is to provide the type of intellectual and social environment which furthers the inherent potential of good industrial education.

Symposium—Providing Opportunities for Individual Learners to Reveal Themselves

The Challenge of Peer Interaction to Foster Individualization in Industrial Arts

GLENN NEWHOUSE, *Supervisor of Industrial Arts, Oakland, California*

THE longer one works in the field of education, the less certain he becomes as to the potential capacity of an individual. Like the tiny atom, the innate capacity of an individual remains locked within, until something releases it. Most people have far more potential than is ever developed or used. This fact is a real challenge to educators since this is a loss not only to the individual, but to the society in which we live.

One of the most promising means of releasing latent potential is by individualizing the education and making it appropriate and meaningful to the student. Industrial arts offers an area rich in opportunities to challenge and stimulate students.

Every resourceful teacher has used reliable students in his class to assist other boys to achieve their selected or assigned objectives in the industrial arts program and with class organization. Among the more common examples are assisting with attendance records, supervision of safety, the finish room, tools, clean-up procedures, or other assignments for areas of responsibility that free the teacher to individualize his instruction.

Some boys make excellent teaching assistants, and many students informally help their neighbor to solve some problem that has puzzled him. It seems probable that in many instances students can transmit knowledge and skills to their classmates more readily than the teacher. Whether this is the result of the boys' greater insight into peer group thinking or the absence of fear of appearing stupid in the teacher's eye, this technique of encouraging student cooperation and interaction is effective in improving the individual's learning.

Increasing pressure of legislated educational requirements has made it necessary for administrators to schedule boys of widely varying experience and abilities into the same shop class. The skillful teacher can do much to avoid making this handicap interfere with the effective learning and student progress in his class. Capable boys serving as group leaders of small sections can aid learning quite effectively. We all have found that one of the most effective ways of really learning a body of knowledge or a skill is to teach it. One must be well prepared and thoroughly competent in order to be able to teach a topic; and by the time he has repeated it in the many ways necessary to achieve group understanding, the group leader is not likely to forget that subject. Teachers must work carefully with their student assistants to be certain that they understand and accept the designated objectives, and they must be alert and ready to supplement or support their efforts in times of need.

One of our senior high school teachers of advanced auto conducts a most valuable program for his students. He has a leadership group elected from each class. The rules of operation are clearly defined and accepted by the boys. They appreciate the value of electing capable officers so that they will be able to work more effectively and also have more time to work in the shop on cars. Boys participating in these classes learn some valuable lessons in planning, assuming responsibility, getting along with their peers and selecting suitable values that may well be the most valuable things they can learn in school. With many of the routine tasks being properly handled by the boys, the teacher is able to do a fine job of working with individuals and small groups.

Kimball Wiles, Dean of the College of Education, University of Florida at

Gainesville, in a recent speech entitled the "Leading Edge of Education," stated one of the leading edges as "student commitment." This objective is vital if individualization is to result or efficiency in learning is to be achieved.

In advanced electronics classes in Oakland, it is not uncommon to find students who have become experts in the area of their specific interest. These students not only serve a valuable role in helping members of their peer groups in their own class but are often asked by teachers to lecture to their mathematics and science classes in the other departments of the school.

In these instances all electronics students learn the basic core areas of the course in which they are enrolled; but in addition, they are challenged to pursue in considerable depth a special topic or topics of intense interest to them. As students become experts in various diverse areas, the resources of the industrial arts classes and their schools increase at a gratifying rate. In response to a question I had asked regarding a high fidelity system, a very capable electronics teacher referred me to one of his high school students saying, "This boy knows more about this subject than I do." The boy did present a very knowledgeable explanation of the answer. This young man was also a real help to his peers.

The final leading edge of the six Wiles mentioned was "Education and the new instruction." By this he means for the teacher to select the method or methods appropriate to the class or the individual student.

One method that finds particularly good acceptance by the better student in industrial arts classes is that of experimentation or problem-solving.

One of the superior awards winners at the recent California State Fair Industrial Arts Exposition was a working model well supported by two illustrated notebooks of an anti-missile missile. One notebook explained, by word and diagram, how the conventional anti-missile worked, and how it could be circumvented. He then proceeded to illustrate in his second notebook and with his working model a new system purported to be positive in its results. It was necessary for this young man to do considerable research from the printed page and also talk with experts in this field. It is gratifying that industry, their specialized personnel, and frequently their books and laboratories, are made available to these able boys with special problems to which they are committed to finding solutions.

Advanced electronics, drafting, auto and machine-metals, are fields in which the most individual experimentation and research types of projects are being developed. In these classes the interaction of the students is particularly valuable and stimulating. They utilize and respect the student specialists or experts in their group. When you come to the Oakland-San Francisco Bay Area for the American Industrial Arts Association convention next year, you will have an opportunity to see and hear several teachers who are very successful with this type of teaching.

The mass production class project is one where peer interaction is most evident and beneficial. One example of a negative action that had positive results occurred in a wood laboratory where the class was manufacturing a quantity of a needed fixture for the drafting room. Two students continually failed to satisfactorily complete their share of the task. After three days of trying to get these two boys to participate properly, the group met, and with the teacher's permission, "fired" the two poor workmen. The effect on the outcasts was first one of shock and then of repentance. Needless to say it was not necessary to take this extreme action in this class again.

When students can be actively involved in selecting a topic or project that is meaningful to them, the results are more likely to be educationally successful. The interaction of his peers is a successful catalyst that can release latent student potential in the industrial arts classes.

What Challenge Is There for Making Industrial Arts a Program for Trying Out Ideas, for Testing Skills, and For Using Knowledge in a Variety of Ways?

EVERETT R. GLAZENER, *Associate Professor of Industrial Education, Texas A & M University, College Station, Texas*

WE have many problems—the drop-out, the academically talented, the slow learner, unemployment, areas of poverty; and the list could become almost endless. Each individual must get all the ideas he can and formulate his own answers in an intelligent, effective way to fit his individual program and situation.

If it were possible to adopt immediately an appropriate industrial arts program throughout the country to meet everyone's needs, we could provide the answers to many problems. We can possibly form such a guide, but I do not think there is any such magic formula to fit everyone. Yet, many people seem to seek it. There are many looking for some trend or another and making numerous pronouncements; they exclaim, "Eureka! This is it!"

I'm not especially impressed with trends, because anyone can look in any direction and find a trend. The trend you want depends on what your biases are and what you're looking for. You occasionally find a localized trend that is legitimate, which produces some educational fad and gets many on the bandwagon. It also helps somewhat to stymie thinking by individuals who accept the trend without analyzing the whole idea as it relates to the entire field. This may sound antisocial or unprofessional and may be overstated because of our lack of time for presentation and total discussion. By all means, do not think I am against change; but someone has stated essentially that change is not necessarily progress, and neither does historical standardization always make a practice good. I merely suggest that we pay close attention to our own experiences, knowledge, background and local situations and not be easily swayed or snowed by other advice, suggestions, or admonitions toward a trend.

It is common knowledge that our population is increasing, we live better generally, people are more mobile, we have more urbanization, more leisure, better communications and transportation, and increasing changes in industry and/or technological concepts which create a need for technical manpower.

We have made some effort toward development of power mechanics (including fluid power) as a content area. We have developed some electricity and electronics programs. We have progressed considerably since World War II, but there are some additional ideas which I believe are challenges to all of us. When we do these in an intelligent, effective way, I think our industrial arts program will then be a better place for individuals to try out ideas, to test skills (both mental and manipulative) and for using knowledge in many ways. This will be our contribution to the over-all education of individuals as well as groups. We can't be a cure-all for everything that ails education but we can help do our share.

A well-known superintendent of schools in Texas recently spoke to one of approximately 12 area industrial arts associations and emphasized the following remarks:

"I seriously regret that I have never had an industrial course and have no real hobby or leisure-time activity. I know of no other area of our educational curricula which can help educate all youngsters from the mentally retarded to the mentally talented . . . no other area which, if taught decently, meets our over-all educational objectives any better—to train nearly all people in real physical and mental skills.

"It is unfortunate that there still remains a general public stigma about vocational industrial education and industrial arts in education. A strong industrial arts program should precede strong vocational programs where the latter are needed and justified. However, we can justify every penny spent for salaries, buildings, tools, machines, and other expenses for these programs if for no other reason than the future adult values they offer.

"It is my opinion that a good industrial arts program will do or help do the following: 1. Detect certain aptitudes. 2. Motivate desire. 3. Give a knowledge of safe use of tools and machines. 4. Develop a degree of skill, not necessarily a saleable skill, for each level on which it is taught. 5. Increase holding power, especially for those with dexterous abilities and still make them think. 6. Offer a broad opportunity to understand a technological society. 7. Help students see math in a new light and make it live. 8. Even help teach other areas such as English and science by putting these academic learnings in action."

To follow these ideas, I would like to point out some general challenges which we face.

For entrance into many colleges and universities they seem to be demanding additional preparation in certain academic courses. This limits elective courses even more. In many instances lay people, administrators, and others still have a lack of understanding of our goals and purposes. Educators of all types are slow to change, and we may not be receiving the monetary support we need. Helping correct these factors is one of the first challenges we must face.

With all due respect to our counselors in public schools and elsewhere, I ask these questions: Are they really assisting youngsters in selecting and preparing for a vocation? Or, are they setting themselves up as psychologists and educational advisors of college-bound youth only? If the latter is true, then this becomes a second general challenge to each of us to help correct.

We have a challenge to emphasize more understanding of industry—the technological, the engineering, and the manufacturing aspects.

Where possible, we need to create more programs with specialized depth for the college-bound, academically-talented students where applied science and mathematics are involved; programs for the slow learner; and to enrich our present programs for the great bulk of so-called average students.

We must overcome complacency among teachers in the field. We can only be a profession by being professional.

Teachers must consciously plan learning experiences with the ultimate goal of improving problem-solving abilities. The teacher can do this by closely regulating directly and indirectly the conditions guiding the student.

We can provide additional guided experiences, probably through research and experimentation, for those best able to benefit from this type of learning.

Definitely make a project the means to an end, enriching such activity with various forms of additional learning activities related to the project itself.

Symposium—New Methods of Teaching Which Will Enable the Industrial Arts Teacher to Develop More Fully Our Human Resources

The Employment of Para-Professionals And Teacher Aides

IVAN HOSTETLER, *Head, Department of Industrial Arts, University of North Carolina, Raleigh, North Carolina*

THE term "para-professional" is not listed in the latest unabridged dictionary. However, the prefix "para" is described as "closely resembling the true form . . .

almost . . . associated in a subsidiary or accessory capacity." So one might describe "para-professionals" as persons not fully certified as teachers but with most of the other qualifications. They work with teachers as helpers or teacher aides. Their salaries are about half that of regular teachers and they have very few decision-making responsibilities. Perhaps the term "teaching technicians" would be more accurate and more descriptive.

I think we would all agree that many teachers are loaded down with too many routine duties and extraneous responsibilities which keep them from doing the best job of teaching. In an article published in the IAVE magazine in 1960 on what I envision industrial arts in the public schools to be like in 1975, I suggested that the schools would be large enough to afford two different laboratories—the skills laboratory and the laboratory for experimentation and research. Each of the laboratories will have a master teacher whose salary will be $15,000 or more. Each of these teachers will have 4 or 5 teacher aides (para-professionals) who will be responsible for many of the routine activities referred to above.

In order to determine how teacher aides, para-professionals, or teaching technicians are used in our industrial arts teacher-education programs at both the graduate and undergraduate levels, questionnaires were mailed to 25 heads of departments in various parts of the country. Twenty-two responses were received. The results of their responses were as follows:

A. Number of teacher aides
    1. Range of number of graduate assistants 0-10—mean 3
    2. Range of number of undergraduate assistants 0-40—mean 8

B. Responsibilities of graduate teacher aides: Teaching assistant in laboratory, 9; research assistant to staff, 5; prepare teaching material, teaching aids, 5; supervise open laboratories, extra time, 5; responsible for teaching one lab course, 4; test construction, score tests, keep class records, 4; library research, assist with research project, 3; substitute teaching for regular staff, 2; shop maintenance and development; write specifications, order supplies; assist in planning new buildings and facilities; relieve teacher for main task—teaching; aide to the department chairman; advise graduate and undergraduate students; editor of department news bulletin; edit articles for professional publications; plan programs for visiting educators; observe and assist with teaching driver education; assist with conferences and special programs.

C. Responsibilities of undergraduate teacher aides or para-professionals: Tool and machine maintenance, 17; prepare teaching materials, teaching aids, 8; lab assistant to instructor, 7; shop improvement, tool panels, display areas, 5; department and college printing, 3; design and develop equipment, 2; grade papers, 3; assist with conferences and general programs; supervise open labs; gather resource material, develop handouts; technician (50-yr.-old assigned to division maintenance, construction, repair) supervises 3 or 4 undergraduate students in work.

Team Teaching and Creativity

H. O. SCHORLING, *Chairman, Industrial Arts Department, Fresno State College, Fresno, California*

THE following quotations have significant relevance for this conference which has directed itself to the problem of human potential and development:

> "In young children creativity is universal. Among adults it is almost nonexistent. The great question is what has happened to this enormous universal human resource?"—Harold Anderson
>
> "Let our teaching be full of ideas. Hitherto it has been stuffed only with facts."—Anatole France
>
> "If a student flunks once, he is out; but an inventor is almost always failing—he tries and fails a thousand times. These two things are diametrically opposite. Our biggest job is to teach how to fail intelligently—to keep on trying and failing and trying."—Charles Kittering
>
> "Many men have found they get original ideas when they systematically challenge the obvious."—Leo Nejelski
>
> "Look sharply after your thoughts. They come unlooked for, like a new bird seen on your trees and if you turn to your usual task, disappear."—Ralph Waldo Emerson
>
> "The more creative thinking we do, and the more ideas we give out, the more competent we become, and with this comes a most satisfying sense of accomplishment."—Carl Holmes
>
> "As the scope of our creative work depends on our store of knowledge, we should be constantly engaged in enlarging this store by study, experiment, and observation. We must therefore have a high capacity for self-instruction."—William Easton
>
> "All creative work involves work that is a problem, discomfort, application entailing great effort, withdrawal, a plan, and subsequent achievement. True creativity does not come easily."
>
> —Donald MacKinnon

What has been said in these quotations has been said over and over again by great men since the dawn of reflective thinking; that is, the most formidable, the most awesome quality of man is his ability to create.

If we agree that all teaching should be creative, then we have taken the giant step. Our approach to team teaching will be not static but dynamic. The best systems, irrespective of how good they may be, if echoed and re-echoed, can produce only sterility. Much has been said and written about team teaching. All of us have had first hand experiences with it; we have seen good programs of team teaching in operation. There will be more. One thing is certain, the knowledge explosion coupled with the interdependence of the disciplines will demand greater utilization of the techniques of team teaching.

And now, a modest proposal

This proposal is an interdisciplinary plan, actually developed by a group of boys and their teacher in a California high school, for introducing creativity and problem-solving experiences as the core for advanced work in industrial arts. The problem begins with industrial design, or the product design approach; the same way in which the solution to the problems of industry begin. Thirteen boys in Drawing VI-VII, under the direction of Myron Levin, conceived and developed this plan at the San Lorenzo High School in San Lorenzo, California. Will Townsend, the automotive technology instructor, participated in the plan from its inception:

The team, the problem, the purpose

The instructors were Myron Levin, drawing/design; Will Townsend, automotive technology; and members of the industrial arts department faculty. Thirteen students participated, designated as chief engineers, illustrators, senior and junior draftsmen, checker and blueprint technician. In addition to the thirteen boys, all students enrolled in the regular industrial arts curriculum participated in the activity.

The problem was one in automotive design and production. Its objectives: To provide an opportunity for students to apply knowledge and skills to realistic problem-solving situations; to stimulate the use of the creative approach; to stimulate problem-solving and research; and to integrate the activities of the entire industrial arts curriculum.

The success of any program relies primarily upon the proper motivation of the student. The field of automotive design provides a natural stimulus for the teen-age student because he is genuinely interested in the automobile. There is ample research material available in this field, and it also offers unlimited possibilities of exploration by the creative mind.

This program offers the student opportunity to explore possibilities inherent in automotive design and finally to execute a plan which might otherwise have remained only a dream, clouded by many unanswered questions. May I here point out that the purpose of the program is not to develop automotive designers, but rather to offer the student opportunity to explore an idea, to create a design, and to apply learned knowledge and skills.

The team approach is essential to this program. Student teams are formed within each section of the shop area and their work is then correlated by the team of chief engineers.

The project: Sir Charlie's Auto

"Sir Charlie" is the name given by the students to the mythical, scaled-down human around whom the auto is designed—the scale is 9/16. Some of the problems considered in the building of Sir Charlie's auto are presented in the following outline:

I. Research for Materials.
  A. Check for materials on hand: (1) Tubing, wood, metal, angle, sheet metal, plastics, aluminum. (2) Covering material, wire, plaster lath, cloth, glass.

An Emphasis on Providing and Developing Appropriate Research, Independent Study Skills, and Problem-Solving

WALTER ROLLIN WILLIAMS, III, *Associate Professor of Industrial Education, Georgia Southern College, Statesboro, Georgia*

A German general was asked, "What caused Germany to lose the war?" He stated, "It was due to your education system." The American G.I. knew how to meet the problems of the situation.

The duty of public education in a democracy is to develop responsible citizens for participation in the life of that democracy. I feel that the members of AIAA would add that since today is essentially an industrial age, a good citizen must receive an education which develops and extends his knowledge of his industrial society. It is the goal of industrial arts to meet this requirement.

Industrial arts is a phase of general education that concerns itself with tools, materials, processes, products, occupations and related problems of industry. The learnings come through the pupil's experience with tools and materials and his study of the resultant conditions of life.

The unique objectives of industrial arts are: (1) To develop insights and understandings of industry and technology in the culture. (2) To discover and develop interests and capabilities of students in technical and industrial fields. (3) To develop the ability to use tools, materials, and processes to solve technical problems involving the applications of science, mathematics and mechanics.

It is felt that real and full meaning is most effectively acquired by means of first-hand contacts and experiences, and that interests may be explored through the development of manipulative skills in conjunction with academic training.

In industrial arts many methods of instruction are used—lecture, demonstrations, field trips and direct activities (projects) concerned with area studies. The constructional activities are means to an end.

The constructional activities in industrial arts should not have their emphasis on handwork or skill development. They must be concerned with the content of the area. A well-designed constructional activity will develop research ability, study skills and problem-solving abilities. The industrial arts experiences should center on products and materials used in industry. The students should have the opportunity to experiment, create and work with industrial materials.

Creative problem-solving is simply a method of instruction in industrial arts. By using this method, the student can learn much more than subject content. The method within itself contains many important concepts that today's youth should understand. Industrial arts is a logical place to develop problem-solving techniques.

B. Check on school surplus for: (1) Bearings, coverings, gears. (2) Engines (small), clutches, small transmissions (lawnmower), wheels, tires.

C. Scrounge for the others: (1) Check with shop teachers. (2) Ask other members of the faculty, also students.

II. Shop Utilization.

A. Mechanical Drawing: (1) Provides the chief designers and engineers. (2) Division of the class into teams: *a.* Body design team; *b.* mechanical design team; *c.* structural design team. (3) The foregoing are in charge of design in the drawing room, and are responsible to the other shop teams for detail drawings and dimensions. They also supervise the building of the various sections of the automobile by shop teams.

B. Metal Shop: (1) Responsible for the machining of the parts, hubs, axles, etc. (2) In charge of the metal castings for hubs, windshield brackets, etc.

C. Wood Shop: (1) Responsible for the patterns for the castings. (2) Responsible for building the wooden bulkheads in the mock-up for the fiberglass body.

D. Art Metal and Craft Shop: (1) Build the plastic gingerbread on the dash. (2) Spin the aluminum wheel disks and tail lights.

E. Electric Shop: (1) Responsible for the wiring of the car, including head and tail lights, turn lights, and the electric starter.

F. Auto Shop: (1) Construct the chassis unit, install the engine, manufacture and install the power train, the brakes, and the steering unit. All building is done under the surveillance of the chief designer of the chassis unit. (2) From the drawings, the body is built at the same time as the chassis. (3) Responsible for building the jigs to check the tolerances, steering, tracking, etc.

G. Body: (1) Built by the designers and the engineers and other workers in the shops.

III. Future of the Program.

A. The possibility of a design contest involving the entire student body.

B. New ideas: Look to industry for new ideas and new materials; look to industry for new methods. Look for more advanced products that will create more interest in the total industrial arts program. Keep students and public informed—publicity.

As to the plant and equipment, this is a typical California high school industrial arts facility. However, it is not typical in enthusiasm, vision, cooperation and inventiveness. It is a modest but enlightened example of team teaching. But it is much more, for in this plan the method of industrial arts is as important and as illuminating as the discipline itself. Just as the light of the techniques of the liberal arts tends to brighten our lives, so does the light of the techniques of industrial arts brighten the vision of the educational society.

Many industrial arts teachers do not try to be creative or use the problem-solving skills to any extent in their laboratories. Many feel they are not talented in this area, yet they sometimes call themselves "Jack of all trades." By this statement, I think, they are indicating their problem-solving ability. Who is the first person contacted when a problem, particularly one of a mechanical nature, arises in your school? I have an idea that it is the industrial arts teacher.

Dr. G. A. Milton of Stanford University found in a study of "The Effects of Sex-Role Indentification upon Problem-Solving Skill" that masculine men will solve problems more readily than feminine men; and similarly, the more masculine women will be better problem-solvers than women who have a greater identification with the feminine role. To me this has certain implications to industrial arts because many phases of industrial arts include "masculine" type areas, such as machine shop.

Alex Osborn describes the problem-solving process as:

1. **Fact Finding.** ***Problem - Definition:*** Picking out and pointing up the problems. ***Preparation:*** Gathering and analyzing the pertinent data.

2. **Idea Finding.** ***Idea - Production:*** Selecting from resultant ideas, adding others, and reprocessing by means of modification, combination, etc.

3. **Solution Finding.** ***Evaluation:*** Verifying the tentative solutions by tests and otherwise. ***Adoption:*** Deciding on and implementing the final solution.

As stated before, industrial arts is a study of industry so its seems that many problem-solving situations should be developed around it. The instructor might assign or choose an activity from a list of projects. The activity might be to:

1. Develop a flotation cone to separate hard coal and slate.
2. Construct a tester indicating the strength of different types of wood.
3. Develop and explain a pulpwood grinder.
4. Make gasoline.
5. Construct and explain an auger press mill in ceramics.
6. Develop and explain a hammer mill rock crusher.
7. Construct an injection molding machine for theromoplastics.
8. Construct a device to illustrate the tracer techniques of duplicating shapes.
9. Make an impact testing machine or a solar furnace.

The problem-solving concept is not limited to process models. If the design aspect of the traditional industrial arts project is emphasized, the factors of research, independent study and problem-solving are used. Canned projects are somewhat questionable. Emphasis should be on what is needed in the environment of the student. When industrial arts teachers use copy book projects much of the value of creative thinking is lost. Alfred North Whitehead believes that constructional activities provide creative exercise and he feels that there seems to be a reciprocal influence between brain activity and manual activity of the right kind. These activities should cause the student to do a great deal of research, independent study and work through the complete problem-solving method.

Many problem-solving activities are not "take home" projects; however, this does not concern me. The project is a means to an end. Therefore, the project must be developed around what learning should take place within the student and not what he can take home to Mom. We, as industrial arts educators, must develop problem-solving situations within our classrooms. I think we can meet the challenge.

Symposium—Coping with Individual Differences Within a Group

Application of Differentiated Assignments

JOSEPH A. SCHAD, *Professor and Head, Industrial Arts Education, Virginia Polytechnic Institute, Blacksburg, Virginia*

As a member of this panel my chief responsibility is to make some suggestions on how we might utilize differentiated assignments in industrial arts laboratories, shops, and classrooms. Underlying the need for such a pattern of operation are the following premises:

1. That we cannot operate one-track common assignment programs and challenge all comers.

2. That we cannot attract or hold the better and more able students if we do not provide challenging learning activities for them.

3. That we need differentiated assignments to meet varying individual aptitudes, abilities, and interests.

To implement differentiated assignments in industrial arts environments, one may use four approaches. There may be other avenues, but at the present time this writer sees four methods of operation. The first calls for varying the quantity of work for each homogeneous group; the second, for varying the difficulty of the work; the third, for varying the type of work; and the fourth approach depends on utilizing a division of labor which calls for role-playing activities and the performing of different tasks by members of the class.

Applying the principle of varying the quantity of work, let us say, in a drawing or design class, the instructor would, for each of three groups (the slow or low group, the average or middle group, and the above-average or top group), vary the number of required exercises, plates, problems or assignments to be done during the teaching-learning period. Group A, representing the slow or low group would be expected to complete X tasks in a satisfactory manner during the course of instruction. Group B, the average or middle group, would be expected to complete satisfactorily *X* plus *Y* tasks; while Group C, the above-average or top group, would be responsible for the satisfactory completion of *X* plus *Y* plus *Z* tasks. Using basically the same approach, the number of required assignments could be varied by groups for most other industrial arts subjects.

Employing the approach which calls for varying the difficulty of work among homogeneous groups that comprise a given industrial arts class, again using an illustration from the field of drawing and design, the instructor would assign to the slow or low group, problems calling for the completion of views using partially-completed views and projection methods. The middle or average group would be assigned live model problems that would require learners to: (1) secure through the use of measuring devices such as scales, calipers, gauges, and micrometers, all needed data; (2) plan the number of views and layout; (3) draw the essential views; and (4) write or provide the needed specifications. The upper or above-average group would be given verbal or written problems which would call for applications of creativity and the finding of solutions to realistic problems. For this upper category of students, one problem might call for designing and drawing a convenience outlet which would be an improvement over that which is now commonly found in the home.

Another example of varying the difficulty of work may be made by using an illustration from the field of communication, or electricity. Suppose that the unit of subject matter under study is magnetism and that we have our three levels of ability in the classroom or laboratory. The slow or low group would study magnetism using an elementary level book. The average or middle group would study the topic by using an intermediate level book, while the above-average or top group would pursue the study of magnetism by using a high school or more advanced text.

A third way of making provision for utilizing differentiated assignments in the industrial arts laboratory or classroom is by varying the type of work among the groups. Whether the environment is a unit or multiple-activities laboratory, the slow or less able group would undertake projects prescribed by the teacher and would quite likely use teacher-prepared instruction sheets—yes, even the conventional job sheet. A degree of self-direction and initiative would characterize the activity of the average or in-between group. Individuals in this group would be encouraged to choose their own projects, modify designs and specifications and prepare appropriate plan sheets. For students in the above-average or upper group, the guidepost would be product development stressing creativity and decision making. Scientific projects and research and development problems would characterize some of the activities of this high ability group.

The fourth approach for implementing differentiated assignments utilizes procedures which require a division of labor among members of the group or class. Three patterns of operation are possible. One calls for group, team, or committee projects or problems. The second calls for a mass production undertaking involving the entire class, while the third pattern requires the employment of a method of teaching known as the unit method. Brief descriptions of the three patterns follow.

The group or committee form of organization calls for dividing the total class membership into three, four, or five heterogeneous committees, and assigning to each group a problem to be solved. The group study, undertaking, or project might be a model house, an electric sign and flasher, a replica of an oil refinery, a steel mill, a wind tunnel, and the like. Because group projects involve a range of simple and complex hand and machine skills and different degrees and applications of technical knowledge and know-how, all members of the committee are able to contribute unique strengths to the project. Group or team porjects will work in most industrial arts laboratories. We may need to use imagination but the possibilities of group projects are greater than perhaps some of us realize.

Where the instructor desires to involve the entire class in a common activity, the mass or industrial production project offers great possibilities. Here the class decides on the product to the manufactured. A company is formed with the members of the class playing one or more roles. Some members perform managerial activities, others carry out engineering and associated tasks, and others engage in production work. The mass production method of teaching utilizes all levels of talent within the class and permits a division of work commensurate with ability and interest.

A final pattern of operation for employing the division of labor approach utilizes the unit method of teaching. Here the theme or instructional unit under study is divided or analyzed into sub-topics or divisions and class members choose one of the sub-topics for study. Findings are then presented to the total class and a discussion ensues. Since the study of sub-topics requires, on the part of students, different degrees of effort, aptitude and ability, it seems desirable that the instructor put forth great effort in matching up assignments with student backgrounds and interests. For a unit entitled "Non-ferrous metals," some of the assignments might be: Elements; alloys; brass and its manufacture; copper smelting; bronze and its manufacture; properties of copper; melting points of selected elements and alloys; uses of common non-ferrous metals; hardening and annealing copper; copper mines in the U. S.; technical and non-technical occupations in the non-ferrous metals industry; early uses of copper, etc. The unit method of teaching offers great possibilities. Perhaps we should all investigate its potential.

We have been hearing about individual differences since undergraduate days. We continue to hear about the importance of meeting individual needs and some of us, in an effort to meet these needs, use workbooks, contracts, instruction sheets, programmed materials and differentiated assignments. Most of us, I suspect, have our students study the same subject matter, construct similar projects, perform the same experiments, use a common text, use common references, and perform basically the same activities. Differentiated assignments will help us to get away from lockstep procedures that call for everybody doing essentially the same thing. In closing, may I suggest that you consider using differentiated assignments in your program of instruction.

Flexibility in Assignments as a Means of Coping with Individual Differences

ROBERT G. HOSTETTER, *Associate Professor of Industrial Arts Education, Millersville State College, Millersville, Pennsylvania*

LINDBERG and Moffitt, in "Individualizing Education," say that a student not only learns at his own rate, but he learns in his own special way. Since his background is different from that of any other person, he will approach learning in a manner that is unique for him. This fact challenges many of the beliefs to which we have adhered in teaching industrial arts and will cause us to change some of our practices. We all have seen classes working on like projects in the same manner because the instructor felt this experience was needed by each and every student. It will also be necessary to cast aside the uniform level of performance for all students in what we now refer to as grade levels, and the standard areas now found in our industrial arts laboratories will not satisfy the individual interests of all students. The cumulative records we now have will not serve to inform the teacher of the many faceted interests, needs, and abilities of each individual.

Before we can nurture the individual we must know a great deal more about him than teachers of industrial arts presently know. We no longer ask ourselves the question, is this student ready, old enough, to study the heat treatment of steel, but we must ask for what aspect of the heat treatment of steel is this particular student ready. Our system of grouping students has led us to feel that all students in a class are ready for the same instruction at the same time.

Goodlad at the University of California in his article in the March 20 issue of the *Saturday Review* says that "progress through any sequence of learning is only very loosely related to age. The number of years a human being has lived is a poor yardstick for determining what he is ready to learn."

It is also noted in the writings of Jeff West and Ronald C. Doll that a great need of our times which transcends the curriculum and instruction as these are ordinarily conceived, is to find ways of drawing upon human potential through skillful teaching. The committee of the Association for Supervision and Curriculum Development devoted its efforts to this thought in developing the 1964 yearbook. The central theme of this book may be expressed in this statement: "It is toward the discovery and release of hidden powers that educators need unceasingly to bend their efforts. Teachers need to emphasize discovering of potential in learners. The continuing process of self-discovery gives the content and learning personal relevance."

It would seem very evident that we have reached the heart of the topic, namely, providing for individual differences through flexibility of assignments. Lloyd Trump offers this suggestion in his recent article in the *Phi Delta Kappan,* "The present conflicts among subjects in competing for pupil time need to be resolved by programs of basic and depth education that provide logical and sequential content for each student in all areas of human knowledge. At the same time, each student needs opportunities for study in depth in those areas where he has special interests and talents. Flexibility further requires that each student be able to progress through the various phases of these subjects according to his own talents and interests.

Again it is immediately evident that in order to prescribe the most helpful course of instruction for an individual, the teacher *must know the individual.* Is it possible for the industrial arts teacher who meets the student for such a limited time and has so many names in his roll book to know all the students well? In comparison, consider the teacher in the self-contained classroom. This simple question may be considered. Which is more important, to know the subject we teach or the personality whom we teach? In taking a look at the situation found in the self-contained classroom of the elementary school, the ultimate goal is achieved by carefully attending to the needs and potential of each child. The teacher always considers each individual's needs and abilities when making a schedule of assignments. This plan considers human potential and is designed to nurture and develop it, and assignments must be flexible.

We of the Council for Elementary School Industrial Arts are proud to say that many teachers in elementary schools are providing desirable experiences for children by including construction work as an avenue of development for those who have shown creative aptitude in this area.

With this reference to the use of industrial arts in the elementary school comes the reminder that the future use and growth of our discipline may depend to a marked degree upon the importance junior and senior high school industrial arts teachers are willing to give it today. Reference was made primarily to the elementary program because it is felt that in this area the teacher has shown us an excellent example of applying flexibility in assignments.

How can the teacher at the junior and senior high school levels, with his limited information about and association with the student, be more efficient in making flexible assignments, adapted to individual needs? To be a worthy member of the profession he must do more than teach the content of the discipline and must realize that individual needs must be met if he is to develop human potential to the utmost. This realization places more importance upon what happens to the student and possibly less emphasis on subject matter. In evaluating a teacher might ask—Is the student being offered what he needs most? What are his strengths, weaknesses, experiences, and goals for the future? What background information can be obtained from the student's cumulative records? Furthermore, do teachers take time to carry out this much-needed procedure? There are those dedicated members of the profession who "go beyond the line of duty" to learn about individual students in order to provide flexible assignments of an enriched nature for their classes. Unfortunately, in some cases the administration dictates a policy which is unfavorable to flexibility.

Industrial arts is an area which holds much that could captivate the interest of the younger generation today. In order to present the most meaningful experiences to industrial arts students, the following suggestions are submitted:

1. Explore all possible avenues in order to gain background information about the individual student.
2. Plan the program for each student that will be appropriate to his needs and aptitudes.
3. Provide facilities in a laboratory which are in keeping with the space age in which we live.
4. Make use of the available aids which have been developed in the fields of programmed instruction and multi-sensory techniques.
5. Guide and stimulate students into an evaluation and use of their own capacities.
6. Provide guidance in using talents in the various areas of our technological civilization.

Our concern again is for the teacher who is confronted with this all-important task of providing flexible assignments. A workable plan for the development of teaching procedures is outlined by Ned Flanders who points out that teachers need training to develop their sense of acceptance toward students and their needs.[1]

In conclusion, our task is great. We know that individualizing of instruction means work. Flexibility in assignments is hardly possible without going the extra mile.

There is no substitute for a sympathetic understanding of the student on the part of the teacher.

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[1] Ned Flanders, "Teacher and Classroom Influences on Individual Learning," *Nurturing Individual Potential,* A. Harry Passow, Editor, Report from A.S.C.D. Seventh Curriculum Research Institute, Washington, D. C., A.S.C.D., 1964.

Working with the Individuality Of Our Students

HOWARD S. DECKER, *Chairman, Department of Industrial Arts, Appalachian State Teachers College, Boone, North Carolina*

LET us consider first two basic assumptions necessary to the intelligent development of this subject.

First, let us realize that as a whole, the American ideal—the American image—the American value system—is based on a material standard of living which is both a cause and a result of the sum total of our social and industrial development—since the very beginning of our nation. The *product* of our industries is not a stranger in any part of the civilized world. The project, the industrial arts equivalent of an industrial product, should therefore not be strange to this nation's shops.

The second basic assumption has to do with the fact that much of industrial arts work should be expressive in nature, and by expressive I mean that this work should be such that the student is encouraged to express himself, his problems, his way of looking at the world, etc., in some concrete media, be it wood, metal, ceramics or plastic, in such a way that those talents with which he was endowed by birth are given opportunity and encouragement to grow to their greatest potential. Given these two basic assumptions, every industrial arts educator must reach the inescapable conclusion that individually chosen projects are one of the essential techniques of an industrial arts shop situation.

Given the necessity to use individually chosen projects, let us now examine for a few moments the implications of our conclusion. First, let us consider how a teacher must go about using individually chosen projects, executed with a high degree of craftsmanship, to their best advantage. He should begin by viewing his students, not as a mass of humanity nor a group but as individuals. He should try to identify the inherent talents of each individual and nurture these talents to their fullest expression. He should realize that by the time the child reaches his shop he has lost most of the childlike open-mindedness which characterized his early growth period. He must realize that he is dealing with a serious minded youth who is unsatisfied with the uncontrolled design and expression of childhood—with a person who is becoming increasingly aware of adult standards. Viktor Lowenfeld has investigated this phenomenon in art education and every industrial arts teacher should make himself aware of these findings since they hold so much implication for industrial arts teaching. The challenge to the industrial arts teacher is to preserve the open-mindedness of childhood-conceived standards while encouraging the orderly transition of this individual to young adulthood and the standards amenable to this age group. This change of standards should be gradual. Lowenfeld states that the more we prepare the student . . . to use approaches in making things which can stand critical awareness, the smoother will be his growth into adulthood.

The first opportunity of the industrial arts teacher, therefore, would seem to be the use of designing, planning and executing individually chosen projects to bridge that interval between childhood and early adulthood when the student becomes critically conscious of his inadequacies in design skills and craftsmanship.

The second opportunity afforded the teacher in using individually chosen projects is to let them serve as a focal point for the study of industry. It is generally conceded that an adequate study of industry should include at a minimum the following topics: A. Conception of an idea. B. Evolution of the idea into a material object through design. C. Selection of the processes to be used to execute the object. D. Development of pilot model. E. Production of the object including its routing and scheduling, and a variety of controls which lead to the reproduction of the object as many times as the market would demand.

One can readily see that the individually chosen project is the educational equivalent of the pilot model of industry with the student-designer-craftsman acting in the same capacity as the idea man, the designer, the draftsman, and the person responsible for executing the pilot model. He is thus performing the functions of four essential groups in the manufacturing chain. After he is well oriented in the function of these groups, the time is ripe for his introduction to the production phase.

The third opportunity afforded by individually chosen projects has to do with the psychological need of the whole human race for self-esteem. Every person, be it a child or adult, spends almost the sum total of his energies to meet this basic drive. The students of our schools also are driven by this need to succeed and excel. To some students, it is the speech before the student body, to others a composition in their English course, and to yet others, success in athletics; but to our industrial arts students, it is the successful execution of an individually chosen project that provides the self-esteem and recognition necessary to their egos. It is a mirror image of how the boy thinks of himself and reflects vicariously the self-esteem of the teacher. It is an expression and is directly comparable to the painting in art, the recital in music and the performance in drama and, like these expressions, is to be judged on how well the person performed. Any flaw in the project is the equivalent of a wrong note in music, a discordant element that requires further practice to remove.

The poor student—the slow learner, the low I.Q.—will always be with us and in any area of human endeavor, he will only partially fulfill the ideal; but when he does his best, and we have achieved that perfect balance between learning and capacity, we can do no more. In working with this student, we can only hope to so structure the situation that the tasks, though simple, are within his capacity to execute well, so that he may receive that modicum of praise which is his due.

In the case of the bookish-oriented student—the bright student, the gifted student—the industrial arts shop, instead of being bookish, should become the balance wheel to provide such richly-endowed students with the opportunity to express themselves in the concrete media. In this age of specialization, our general education programs should guard zealously their right to provide a variety of experiences. All of the expressive arts should be well represented in our modern curriculum and they should stress the opportunities they provide for creative individual expression. In this way, it is hoped that we can develop, at least a little bit, the attitudes of these gifted people who will be the future leaders of our society.

Application of Differing Quality Of Standards

ANDREW K. AULT, *Instructor of Industrial Arts, West Virginia University, Morgantown, West Virginia*

WE are all aware from our experience in the classroom and shop that some students excel in working with problems of an abstract nature while others excel in working with problems in the non-abstract areas of industrial arts. Occasionally we are blessed with those who excel in every phase of industrial arts. Of course, we cannot overlook or forget the poor souls who struggle for what little success they are able to achieve. What standards shall we have for these people?

Traditionally, we are expected to devise some system of measures to determine whether the objectives and goals agreed upon are being accomplished by the students and the teacher. It can be readily seen that to set up varying standards to meet individual needs and differences is a gigantic task. Yet, we must have some standards and they must be as objective as possible and at the same time flexible enough to meet the varying situations that normally exist in our classes.

We must not overlook our responsibility for the over-all development of our youth. They need to be taught early to recognize the unique worth of all individuals, regardless of race, color, creed, or social standing; they must learn to work with each other and for each other and to recognize that sometimes the needs of the group must transcend those of the individual. We need to stress the dignity of labor and emphasize that the gains one makes in this world of the future will be an ever more demanding struggle against the limita-

What standards can we establish to measure such values as these?

Let us not despair. Someone said, "Nearly everything in life worthwhile is the product of slow growth. Mushrooms spring up overnight but oaks require ages. A fad lives but a short time, truth endures forever."

M. J. Rathbone, Chairman of the Board and chief executive of Standard Oil Company in an address to Pace College, N.Y., students had this to say in discussing the type of individual needed for managerial positions. He quoted the late Robert Wiener, one of the prime movers in cybernetics.

"The world of the future offers little hope to those who expect our mechanical slaves to offer us a world in which we may rest from thinking. The world of the future will be an ever more demanding struggle against the limitations of our intelligence, not a comfortable hammock in which we can lie down to be waited upon by robot slaves."

Rathbone says the man of the future must be a decision-maker and make decisions in which nobody knows all the answers. He must be able to think clearly and logically and to not be upset by the complexity of the situation. He must be able to communicate and express himself under all sorts of conditions, and to all kinds of people. Finally, he must have an aptitude for persuasion and leadership. He must see people as individuals with aspirations and values of their own and be able to provide the incentives which will bring out their best efforts.

Rathbone concluded by suggesting that educators leave a wide margin for error since their job is to prepare youth for a future nobody really knows. The only thing that is certain is change, and an accelerating change at that.

Ernest Hilgard of Stanford University, in his article *The Human Dimension in Teaching,* relates that he knew a dean of one of our liberal arts colleges who would have been rejected from graduate study if the standards of selection in his day were those of today. He was making the point that if bad teachers may in some sense become great teachers and unsuccessful students may in turn be successful professors, we can see we are dealing with a pretty complicated set of relationships. Dr. Hilgard says we are to be concerned with student's development of identity in the direction of seeing himself as a competent, effective, creative, and socially responsible person, capable of achieving mutuality in relation to others.

The appraisal of pupil progress and achievement is an intricate and involved process and especially so in industrial arts, for several reasons. One is the lack of agreement concerning the objectives of industrial arts. Another, should we have a standard body of content which would become the common core of all industrial arts programs? Or should the objectives, methods, content and the like be evolved to meet local needs of the community, school and the individuals being served? We all agree we must have some standards for direction but how to determine these and implement them is the challenging problem.

We also recognize we must have a system of evaluation to provide a basis for assigning marks, to motivate pupils, to improve instructional procedures, to provide a basis for reports to parents, to facilitate transfer of pupils from one school to another, to provide a basis for advancement, to facilitate guidance, to help identify remedial needs and to provide a basis for selecting and admission of students to advanced programs. Whatever evaluation standards we use, we must not lose sight of the fact that the main purpose is to contribute to the maximum growth and development of the individual.

Ask any industrial arts teacher if he has standards for performance and achievement and he will no doubt say "yes." Then ask him to explain, to define his standards and we will find he is in trouble trying to define what he means in concrete terms.

How do we appraise skill in use of tools and machines? Is the standard how well we can do it? Or is it how well it should be done by industrial or trade standards? Or is it how much better the student is performing now than previously?

How do we appraise over-all work habits and attitudes? Is the pupil developing and growing from the standpoint of safety? Does he work well with others? Is he considerate and cooperative? Is he a better person as a result of being in our class?

How do we appraise the development of an understanding of our industrial technology? Is the student aware of the basic industries and their importance to our way of life? Has he become aware of the many employment opportunities in the industrial and related fields?

How do you appraise the importance of planning and problem-solving? Have the students learned to plan their work and think through problems? Are they able to interpret drawings and sketches as well as make them? Are they copycats or do they have the desire to do something a little different?

I must confess, I do not know the answer we are seeking. It is my hope some of you may help us in tackling this perplexing situation in which we are all quite concerned.

The above points, manipulative skills, habits and attitudes, understanding of our industrial technology, planning and problem-solving, are the main factors I consider in appraising my pupils' growth and achievement in industrial arts. My standards are quite simple—to motivate every student to do the very best he possibly can with what he has to work with. My philosophy has been that no student of reasonable intelligence that tries should fail. This is especially true for the first course in industrial arts in the public schools.

The Extent of Individual Differences

WILLIAM A. BROTHERTON, *Associate Professor, Memphis State University, Memphis, Tennessee*

THE life career of an individual has been described as a "broad highway along which every individual must travel . . . . Each individual, with his unique heredity and nurture (including prenatal), will travel along that highway at his or her own rate of progress and will attain the size, shape, capacity, and developmental status which are uniquely his or her own at each stage of the life career."

The fact that each individual is different has, in recent years, been so definitely proved by measurements with tests of all kinds that now there is no question or doubt about it. As Gesell has pointed out: "The range of individual differences is as wide as humanity itself." How much or how little they vary among themselves has not as yet been proved as definitely or conclusively as the fact that they do differ. There are definite indications, however, that there are fewer differences in physical structure than in intellectual capacity. Personality differences, on the other hand, are far more marked than either physical or intellectual differences, and differences in special aptitudes seem to be the most marked of all.

The types of research study that have given us what we know about individual differences include the identification of measurable traits, the exploration of sources of variability in the measurements, the clarification of the relationships of each trait to other characteristics including life-situation criteria, the identification of group differences, inquiry into developmental trends and studies of causation.

Wechsler made an ambitious attempt to assess the total amount of human variability and show how it varies from trait to trait. As a result of the efforts of Wechsler and other differential psychologists the more important task now is to gather information about what measured differences mean in life situations.

Differences in Intelligence

Intelligence is not a material fact but a limiting construct. Learning, reasoning, adapting and other forms of goal-directed behavior are only different ways in which intelligence manifests itself.

Although intelligence is not a mere sum of intellectual abilities, the only way we can evaluate it quantitatively is by the measurement of the various aspects of these abilities. We do not, for example, identify electricity with our modes of measuring it. Our measurements of electricity consist of quantitative records of its chemical, thermal and magnetic effects. But these effects are not identical with the "stuff" which produced them. We do not know what the ultimate nature of the "stuff" is which constitutes intelligence but, as in the case of electricity, we know it by the things it enables us to do—such as making appropriate associations between events, drawing correct inferences from propositions, understanding the meaning of words, solving mathematical problems or building bridges. These are the effects of intelligence in the same sense that chemical dissociation, heat and magnetic fields are the effects of electricity; but psychologists prefer the term mental products. We know intelligence by what it enables us to do.

The most universally used of all indices of intelligence is the intelligence quotient. The great value of the I.Q. is that it furnishes us with a method of defining relative intelligence. However widely used and understood the I.Q. may be as a basic concept in the measurement of intelligence, we must admit that it merely states that a person's intelligence at any given time is defined by his relative standing among his age peers.

As we note individual differences we invariably classify individuals into groups. Wechsler-Bellevue and the Wechsler Adult Intelligence scales statistically grouped I.Q. scores and ranked them according to generally understood titles:

Classification	I.Q. Limits	Percentage Included
Defective	65 and below	2.2
Borderline	66-79	6.7
Dull-normal	80-90	16.1
Average	91-110	50.0

Bright-normal	111-119	16.1
Superior	120-127	6.7
Very superior	128 and over	2.2

Although the I.Q. is the best single measure of intelligence, it is neither the only nor a complete measure of it. Intelligence, like personality, is too complicated an entity to be defined by a single number. It is a function of other factors besides sheer intellectual ability. We know that this must be so, because individuals having the same I.Q.'s may differ considerably in either their actual or potential capacity for intelligent behavior. These other factors—drive, emotional balance, persistence—are not always measurable or even discernible but have to be taken into account in concrete situations.

In the definitive classification of a person's intelligence we also assess the subject's past history, that is, his social, emotional and, in the case of adults, his vocational and economic adjustments. The kind of life one lives is itself a pretty good test of a person's intelligence.

Physical Differences

The extent of physical difference among individuals varies in direct proportion to the number of individuals. In fact, physical differences are extremely important in the study of individual behavior because these differences are observable. Thus they are easier to study than either emotional or intellectual differences. The individual is who he is by virtue of his identifiable physical differences. He is tall or short, slender or fat, blond or brunet, aggressive or withdrawn, friendly or distant, healthy or sick, loud or quiet.

Extreme physical difference constitutes an objective hardship in adapting to the social environment. Shortness, ectomorphy, obesity and retarded pubescent-development place a boy at a serious competitive disadvantage in athletic activities. Cardiac and orthopedic disabilities (differences) limit participation in physical and social activities, and visual and auditory defects restrict the range of sensitivity and responsiveness to important intellectual and social stimuli.

Retardation in motor skills is the basis for many physical differences along with right- or left-handedness and the multiplicity of differences brought about by change in growth for the two sexes.

Socio-Economic Differences

When we speak of the extent of social difference among individuals we generally speak of socio-economic difference. In John Gardner's book on excellence, the very first sentences refer to the fact that, contrary to popular opinion, it is pretty easy "to keep a good man down." The society from which the colonial settlers came was characterized by hereditary privilege—and most human societies have had precisely that characteristic. The Industrial Revolution forced loose the web of hereditary privilege. To those who shaped the revolutionary social change it was clear that by dissolving the false relationships into which society had forced men and by restoring them to their natural state, social hierarchies would be abolished. It was found, however, that when men are released from the hereditary-privilege social hierarchy, great individual differences in performance will emerge and create peaks and valleys of status as dramatic as those produced by hereditary stratification.

There are two ways to deal with dramatic individual differences in performance in a democracy. One way is to limit or work against such differences, protecting the slow runners and curbing the swift. This is the path of equalitarianism. The other way is simply "Let the best man win." Both points of view are necessary yet both can be carried to harmful extremes.

Then what is the extent of socio-economic differences among the children of our schools? This might be easily answered were we living in other societies. However, in a society that recognizes mass public education as a worthy purpose and one that places utmost importance on the worth and dignity of the individual, socio-economic differences run the entire scope of the society from which its school children are drawn. In our classroom are the extremes of the socio-economic scale child who suffers cultural or economic deprivation or both, and we find the boy and girl who want for no social, domestic or material thing.

AIAA and National Safety Council Joint Session

Attitude Development Toward Safety In Industrial Arts

A. Z. PRUST, *Arizona State University, Tempe, Arizona*

How much safety can education realistically build into a society? Knowledge of common safety precautions is not as widespread as might be imagined, and the partial information that people often have serves to create an unwarranted sense of security which may blunt their alertness to danger. Industrial arts laboratories have areas which are potentially hazardous; therefore, the student should be vigilant for his own protection. As industrial arts teachers, we have a continual obligation to make our laboratories safe. Every industrial arts course should have safety consciousness as one of its basic concepts.

Generally speaking, accidents are the result of environmental hazards and/

or unsafe behavior. It has been stated that the objects and forces of the world can injure man, but other factors, such as the variety of attitudes and emotions which motivate actions, should be considered. The lack of favorable attitudes, adequate skills and sufficient knowledge may be responsible for an accident. As industrial arts teachers we need to consider every possibility in order to identify the traits that tend to increase human vulnerability to various hazards. Testing skill is an everyday occurrence and therefore very familiar to us. If sufficient knowledge has been given in reference to the amount of danger involved in a given activity, it is possible the student may not be willing to assume the inherent risk.

Research indicates that becoming a safe worker is a typical learning function. The environment in which a student works influences the formation of attitudes, and the environment reinforces the growth of a widely-accepted attitude.

Psychologists point out that sometimes attitudes are "more quickly caught that taught." From this standpoint, it is essential that we provide and expose young people to desirable experiences and observations. The statement also suggests that good examples set by teachers, parents, and other adults are of immeasurable value in correct attitude formation.

We have one of the most challenging areas in the curriculum. Therefore, it is possible that the industrial arts teacher could greatly influence the student. We've seen the sign hanging in the laboratory or classroom, "Courtesy is Contagious." So are safety attitudes, whether favorable or unfavorable. The teacher's attitude toward safe or hazardous situations will be reflected by the responses of the students—what about the teacher who expresses himself in such a manner as to indicate the nuisance of a guard on a machine?

The Portland, Oregon study conducted by O'Gara revealed that safe attitudes are more lasting than safety rules. The safe attitude, once acquired by the instructor and the student, goes beyond the school laboratory. The report also stated that student attitudes reflect instructor attitudes. The investigation disclosed that the effectiveness of safety instruction was proportionate to safety knowledge and understanding possessed by the instructor. The growth of favorable safety attitude takes place when instruction is carefully blended with enthusiastic, skillful teaching. Behavior is very sensitive to the conditions under which it has been established.

Generally speaking, the frightening technique should be avoided. Many of the signs now used tend to frighten students rather than provide effective programs. Brody states that "No attitude toward safety is sound if it fosters an unhealthy fear of an activity—or if it means a lessening of the intelligent or calculated types of risk-taking that have in the past produced and will continue to produce social progress and welfare." It is very possible that the dread or fear of an activity because of the accident possibilities, may just create a behavior likely to involve the student in an accident.

In our over-all instruction, we must strive for group and individual attitude development concurrently. There are times when group attitude development cannot be overlooked. Scott, Clothier and Spriegel recognized this and made the following statement: "Education is the most fruitful method of developing a positive attitude toward safe practices and the preservation of health. There is room for group effort as well as individual instruction. Positive attitudes toward safety and sound health practices often are more effectively developed in a group than in individual instruction. However, actual work habits are individually acquired, so individual instruction should not be omitted.

In practice, attempts at prevention become more potent when control of environmental conditions has the support of an attitude. People tend to explore the environment and to investigate the possibilities of objects. Locomotion, manipulation, play, investigation, trial and error, insight and problem-solving, involve the skirting of dangers.

This environmental approach to accident prevention is based on the theory that the table saw should be made safe rather than stop a person from using the saw. In school and industry an ideal reinforcer is one which can be applied and withdrawn regularly and the effectiveness of which is more or less limited to the conditions of its use. Cutting off a finger or losing a life is by this definition a very poor type of control. An alternate approach is to consider the reinforcement-maintaining use of the table saw, and to make it contingent only upon safety behavior; that is, the use of the guard over the blade. The reinforcement is having the saw cut through the wood. This is made contingent upon the guard being down—in other words, the saw will not function unless the behavior of putting the guard down occurs. Possibly the switch is under the guard. This principle is incorporated in the automatic washer and dryer. The Heidelberg Printing Press also uses this principle. Is it possible as industrial arts teachers we could work with industrial establishments on a research project using this approach to safety education? In industry this is known as the three E's—engineering backed by education and enforcement. An example is the steel or plastic hat. The worker is educated to the value of the hat. Also, eye-safety programs are strong in industry and many schools have a sincere eye-safety program. What about the chemical area—such as the graphic arts dark room? Are your students and fellow faculty members wearing gloves and other proper apparel when working with these materials? Many hazardous factors can be absolutely removed from the environment, and when this is not possible, hazards which appear in specific operations can be reduced by joint engineering and educational programs.

In industry, too many supervisors, foremen assume the attitude, "What am I, a wet nurse! I have a job to get out and I don't have time to spend on safety!" But management today requires that the supervisor's job, along with getting out production, is to educate his employees—he must teach and train them to work safely. He must follow through and see that safe work practices and habits are used.

It is the supervisor's responsibility to dig out unsafe operations, attitudes and conditions, and to invite suggestions from his workers and weigh their merits. Once industry has the type of supervisor that takes an interest in safety, we will soon see many employees in the department joining the safety team. This will eventually make the supervisor's job easier and the employees will say, "This is a good place to work." But with the attitude—"If the boss doesn't care, why should I?"—in this establishment, you will probably find the accident frequency high. In industry, safety pays cash dividends to management, supervision and employees.

Our laboratories parallel those of industry and often accident-producing behavior has the attitude of profound pessimism, a common attitude that accidents are "built in," evident in the statements, "Accidents will happen," "You just can't change human nature." But, human nature is plastic, it can be modified. Humans have a tremendous capacity for adaptation. Understanding existing behavior is essential and the re-education programs take time, patience and repetition, but we can make our laboratories safer than it is outside of them. A sound safety attitude will not only help a student live safely today, but tomorrow as well.

With this in mind, I asked Harold Kanter to assist me in preparing a set of safety graphs for the graphic arts area. We are now using these reinforcement materials, and we have a pedagogical approach to the teaching of safety. Safety is a functional activity that must be integrated in the shop curriculum; the accepted basic teaching-learning principles must be employed in teaching safety. These are: (a) *Interest.* The student must be *motivated.* (b) *Identification.* Safety must be a *meaningful experience.* (c) *Involvement.* Safety must be a *reinforcement* for the student.

The usual methods of teaching safety in the school shop are: (a) Distributing instruction sheets with either general or specific shop regulations listed. (b) Posting shop regulations and instructions on bulletin boards or near machinery. (c) Oral instruction by the instructor. These methods violate the basic principles and would not be used to teach any other lesson, and therefore should not be utilized to teach safety.

An approach to teaching safety, utilizing the basic teaching-learning principles is: (a) Integrating the teaching of safety with the lesson that is being given at the time. (b) Distribution of instruction sheets that are motivating, easy to understand, do not try to teach too much at one time, and are applicable to the lesson that is being given.

A Psychological Approach to the Maintaining of Safety

1. Maintaining safe practices in the school shop must be just as effective as teaching safe practices.

2. Recent research studies indicate that safety behavior must be reinforced in order to be maintained.

3. There is evidence that the posting of regulations and the distribution of printed safety regulations do not reinforce safety behavior and therefore are often ineffective.

4. The shop teacher can reinforce and maintain safety behavior by: (a) Utilizing safe procedures himself. (b) Teaching safety every day as part of the lesson. (c) Keeping literature and posters up to date and frequently changed so they do not become "part of the wall decoration." (d) Distribution of motivating material that the student can identify with, such as a SAFETY-graph. (e) *Safety devices added to machines so that the student cannot achieve his objective* (and it therefore cannot be reinforced) *unless the machine is operated safely.*

In closing, I would like to make three suggestions:

1. Plan visits to industrial establishments or independent laboratories which would aid in acquainting the administration and also the teaching staff with "what is hoped for or expected or to give a feeling for what is needed."
2. The school has the best opportunity to develop an attitude or determine a method of approach to any problem, technical or otherwise, and it can be accomplished by integration of safety in all course material. The safety concept will carry over into all areas.
3. One of our major steps is the educating of present faculty members. *Safety attitudes begin with the instructor.*

Defining the Ceramics Area For Industrial Arts

L. STANLEY ZIELINSKI, *Associate Professor, Ceramics Department, Industrial Arts Education Division, State University College at Buffalo, N.Y.*

IN the team effort of education my task is a concern with communicating an understanding of what can be summarized in just a single word, ceramics. Exactly what this word implies, however, is truly a formidable task. There is no aspect of man's knowledge of which ceramics does not become a part, there is no man in our civilization who is not directly affected by these things we call ceramics. A most vital link in the total scheme of things, yes, but just a single link. True, we in industrial arts, kiddingly, and half-seriously on many occasions, like to look at the world through the eyes of wood—or metal—or graphic arts—or whatever else is near and dear to our hearts; but in the final analysis, we all know that an educated man is a balance of many things, just as a chain is made up of many links. We would be misdirected and ill-advised, of course, to construct tight little subject-matter walls that would prevent us, or worse still, our students from seeing the total picture. It is imperative to qualify the term "ceramics" for industrial arts, because the same expression is used by thousands of well-meaning souls who say ceramics, but really mean china-painting, pinch-pots, or some other very small part of a very large and complex collection of industries.

There are many formal definitions of ceramics. Those which are significant will usually qualify the kind of materials involved, that is, earthly, inorganic, and non-metallic. There will also usually be a statement indicating a necessary heat treatment at some stage of processing. The word *usually* is italicized because there are several important subdivisions of ceramics that do not fit within the confines of a stiff and formal definition. The overriding approach to a well-balanced definition, once again, is an all-encompassing approach rather than blinding confines created by attitudes or a stuffy definition.

Over a period of approximately seven years, several of us at the State University College in Buffalo have been looking at and constantly readjusting the scope of what constitutes ceramics, as well as experimenting with the sequence of presentation in order to help the student understand this fascinating and constantly-expanding field of information.

It would be presumptuous for me at this point to make any statement which would even imply that this way or that way is the best or only way for you—your school—or anyone else to teach ceramics. In the Ceramics Department at Buffalo, Ed Cridge, Gene Stafford, and I only modestly proclaim that the following general outline, indicating scope, seems to be successful in our present set-up. I am certain our program will continue to change and hopefully grow as we change and grow, and as ceramics changes and grows. Though disconcerting at times, constant change and adjustment is healthy and in industrial arts, change of course is absolutely vital. No aspect of our society is as obvious as our explosive technological growth. To *not* change and *not* be uncomfortable is to be educationally dead!

So to all you live ones, I say first of all, that ceramics is concerned with raw materials as they come out of the earth. Everything we use is in nature's storehouse of raw materials.

Minerals—Rocks and Stone

Lest we be accused at this point of trespassing on geology's domain or the exclusive property of an earth science course, I'll point out that overlaps are inevitable, and if anything, desirable. For many, the brief industrial arts mention of information covered in depth in a formal geology and mineralogy course would serve as a reinforcing reminder. For just as many others, however, such information is new. For both the experienced and inexperienced, there will be a uniform approach which serves as a background for the stone industries. Dimensional stone—this most ancient of building materials—is being used as much today as ever before. A casual look—but a casual look that really sees—will cause an awareness that stone products for building structures such as bridges, homes, tombstones, curbing, industrial and commerical structures, etc., are in evidence in virtually every community throughout the nation. An understanding of what man does and how he accomplishes his purposes in stone is of interest to us. In an industrial arts environment, we can actually experience and thereby further understand how and why a raw material such as stone is selected and removed from the earth. By being able to cut, sandblast, grind, polish, drill, and crush stone, we are better able to understand the occupations of many men producing a host of products that enrich our lives. A visit to a nearby quarry producing crushed stone instills a further understanding of actual working conditions, as well as the scope and scale of the men and machinery involved. We are not the least bit disturbed if side interest in gems or the growing of crystals develops in our students.

Lime

A second category to consider is the material lime. Since time immemorial limestone has been used in the form of dimensional stone. This same limestone, also used in crushed-stone enterprises, when heated produces a foundation material for our vast chemical industries in the form of calcium hydroxide, $Ca(OH)_2$. It is used also in medicine, mainly as an antacid, and in making plaster, mortar, cements, and water paints, as well as many additional diverse uses such as the dehairing of hides in the manufacture of leather. Mortar is prepared by mixing slaked lime with sand and enough water to make a plastic mixture; when put in place in a wall, the slaked lime reacts with carbon dioxide of the air, forming calcium carbonate as the wall hardens.

Besides creating an awareness of additional industries and products that enrich our lives, the simple chemistry involved in the reaction of lime ties in beautifully with the work of our science teachers. Again, an excellent opportunity for a curriculum-united faculty to achieve the common goal of educating youth through the medium of technology—that is, taking a scientific principle and following through to a finished product.

Gypsum

In our definition of ceramics, the necessity of heat is so stated. Heat in the ceramic sense refers to temperatures high enough to produce incandescence, roughly 1100°F. The material gypsum hardly requires 400°F in order to be useful to us as plaster of Paris. There is no denying, however, its necessity and importance. All of us have eaten from dishes made of clay ever since we have been able to eat from dishes. Even a superficial understanding of our clay-forming processes immediately reveals the dependence we have on this most versatile material. Whether it be jiggering, pressing or casting, gypsum is very much involved. Fortunately, we are blessed with tremendous quantities of raw gypsum deposits, and so this comparatively inexpensive material is used in a host of other applications besides clay forming. Anyone who produces models or suggested prototypes of new equipment and products is well versed in its use. The supercolossal Hollywood productions will consume tons in recreating scenery of every imaginable sort. Farmers, doctors, and dentists use gypsum. A student can learn to use and begin to understand gypsum in a matter of just two hours. Granted, this same student could also spend a lifetime in working with this same material. I would be satisfied if eventually all of our students could be exposed for even the minimum amount of time. Plaster of Paris is a fascinating material in that by the simple addition of water alone, it is capable of returning to its original rock-like state in a matter of minutes. We most highly recommend an understanding of the material gypsum and its many products and applications.

Cement and Concrete

In the April 1964 issue of *Scientific American*, the following paragraph appeared: "The most widely-used construction material is concrete, commonly made by mixing Portland cement with sand, crushed rock and water. Last year in the U.S. 63 million tons of Portland cement were converted into 500 million tons of concrete, five times the consumption by weight of steel. In many countries the ratio of concrete consumption to steel consumption exceeds 10 to 1. The total world consumption of concrete last year is estimated at three billion tons, or one ton for every living human being. Man consumes no other material except water in such tremendous quantities."

Here it is 1965. I am continually amazed that so many people, intelligent and responsible people, no less, are ignorant of the fact that cement is a product of the fire. A combination of materials that could be as simple as limestone and shale, when properly proportioned and heated to 2700°F, produces the resulting clinker which is ground to a fine powder. When mixed with a very small percent of gypsum, we have Portland cement. Portland cement is, of course, the primary ingredient in concrete.

Its tremendous use in construction—bridges, buildings and dams, as well as our national highways systems—just cannot be ignored. Examples are everywhere—concrete is a part of our very existence. Such importance and abundance poses the following question: Who in industrial arts should talk about, know about, and do about this aspect of our daily lives? No one but those who profess to say, I am in industrial arts and I teach ceramics. There is no question in my mind that cement and concrete should be the fourth area of the ceramic program.

Structural Clay Products

As a fifth area, bricks and tile of all sorts made from clay are, of course, in the bailiwick of ceramics. Nothing but heat and common earthenware clay is required to produce a brick or tile. Any city the world over has many beautiful examples of structural clay products. Examples ranging from the most ancient of Biblical accounts to construction going on this very instant, attest to the fact that the lowly brick will forever be a building material, looked upon with favor by mankind, made from the material of which the crust of the earth is composed.

A chart from a book by Daniel Rhodes shows an interesting comparison of an analysis of the crust of the earth and common red clay. For all practical purposes, the comparison is identical. A simple, mundane, common brick is truly a sample of the earth itself. No doubt our friends in psychology would have enough information here to explain why mankind has always reacted as he does to structural clay products.

Whitewares

The total content of many courses in industrial arts ceramics is simply some portion of the sixth category which we have designated as whitewares. The pottery approach to ceramics is fine as far as it goes. It is questionable, however, to repeat the pottery process over and over again in an industrial arts program of ceramics. I can appreciate the temptation in something like casting; first of all, it is a very right, legitimate, and important process to know about. Our students should know about casting. My quarrel is with a program that will repeat one poorly-designed casting on top of another in an absolutely endless stream; the shelves are literally sagging under the weight of still more molds to be poured in the next course and I fail to see much educational value for anyone after the first few castings. It is a gratifying process, certainly, in that even kindergarten children can hardly miss having a successful experience, and everyone is a hero when something is cast.

But now, after all, what is casting? It is simply one process; there are many others. With each additional process that could become a part of a program in industrial arts, there is much to be learned. For instance, our dinnerware industries could be better appreciated through a simple demonstration in jiggering. At least one of our more enterprising commercial suppliers enables anyone to incorporate jiggering in the classroom for a very modest investment; the same is true for extrusion. In one of our field trips out of Buffalo, we have been privileged to witness a range of extruded products that would stagger your imagination. At the Lapp Insulator Company in LeRoy, New York (the world's largest insulator plant), there is one extruded product that is only a few thousandths of an inch in diameter. The finished product is only one-eighth of an inch in length. Such a product is then to be contrasted with a column of porcelain which approaches four feet in diameter and ten feet in length. The rough blank weighs over five tons. The finished product is then dry-turned to three tons. Now, five tons is 10,000 lbs! Many of our larger school systems don't use 5 tons of clay in an entire year. Another rather remarkable ceramic product produced at Lapp is an insulator which is used at the bottom of radio transmission towers. The tallest tower at the present time is located in Austria and is 1700 feet high. This tower exerts a compressive strength of over a million and a half pounds. All of this weight rests upon a single piece of porcelain that has been carefully produced by the best engineers and technicians in the industry—certainly a real tribute to modern technology.

There are many ceramic-related products and services which we take for granted, such as radio, television, and electricity in general. Through ceramics, better understanding of these products and services is entirely possible. I would prefer to see a few less castings and much more about jiggering—extrusion, dry-turning, plastic-pressing and dry-pressing.

Glass.

Although we treat separately categories 7, 8 & 9, which are glass, glazes, and enamel, they are very closely related, the common denominator being glass. Again, there is no problem in recognizing the fact that glass, glazes and enamels are earthy products of the fire. As a point of information, 90% of the glass we will encounter in the course of our lifetime, in such products as containers and flat glass, are the soda-lime variety of glass. The major constituents for the product are the earthy sand, soda ash, and lime—very common, and found the world over.

There is still a sizable equipment problem to be licked before we see glass tanks in the public school, but I feel confident it will just be a matter of time before working hot glass will become routine. At the college we are doing it now, but with fairly elaborate equipment. We have also had, however, fair success in glass experiences working with existing school facilities. It is entirely possible in a regular kiln to cast glass, using the lost wax process. Slumping glass is already "old hat." Fabricating glass tubing has also been a long-time stand by. Hot and cold cutting of glass are processes far from unknown. At Oswego, under the very able direction of Austin Blake and John Sommerville, a comparable program has pioneered a host of outstanding classroom activities. Something they are able to toss off as routine is, for instance, the classroom production of fiberglass. Fine educators that they are, they have most willingly and openly shared their developments. I wish to acknowledge my indebtedness to them and wish *they* would stop being so modest. We have had excellent success smoothly drilling holes of any diameter using drill press and copper tubing. Also, we can sandblast through to any depth and shape for which we can cut a stencil. We have yet to make a sizable stained-glass window. From the work done with staining glass and coloring small batches, however, such an activity is entirely foreseeable.

Glazes

Glazing as an area of glass is covered by mixing from batch formulas. In practice many of our graduate students find it more convenient to use prepared glazes though with an understanding of what a glaze has in it from a raw materials point of view, they are encouraged to pursue this activity independently. For those students who choose to go on in ceramics in their graduate programs, glaze calculations have been and will be offered as a regular part of this program.

Enamels

Due to the tremendous number of enameled products that affect our lives directly and indirectly, we tend to be not overly-conscious of their importance to us. We feel enameling is a necessary part of our Buffalo program, and cause our students to have at least a minimum experience in this area as well . Our appliance-filled kitchens and home laundries are a tribute to the enameling industries. Architectural enameled panelling, especially on gas stations, is in evidence, everywhere up and down every road and highway. The clean hot water we take for granted probably was heated in a glass-lined tank. We never question the sanitary quality of beer or milk because here, too, glass-lined tanks are often used. Yes, hundreds of products ranging from fine jewelry to huge silo-like tanks are all lined with glass. Once again, we are able to visit a plant that enamels these gigantic tanks commercially. The Pfaudler Permutit plant in Rochester can handle tanks that require kilns that are five stories high. In the classrooms, of course, we could not and would not want to get so involved. In principle, however, we can and do get involved on a smaller scale.

Refractories

In ceramics, I see more than just metal when I look at a metallic object—were it not for some form of refractory, we would have precious little metal in use anywhere. For every ton of steel produced, there is a surprisingly large refractory brick requirement absolutely necessary. Wherever heat is used in any situation, refractories will be in evidence. From "harnessing the fires of industry" to lining your furnace at home, refractories perform their useful purposes. Here, too, the versatility of this ceramic product, is astonishing. Regardless of temperature, chemical requirement, physical strength, composition, size or shape, there is a refractory solution already available, without a doubt. Here again, we feel a systematic study of the refractory industries and the products they produce (as a tenth area) is a necessary part of an industrial arts program in ceramics.

Abrasives

All of us have used grinding wheels and abrasive papers of one sort or another. Both bonded and coated abrasives are still additional examples of the wide scope of products that are most correctly classified as ceramics. The two giants of today's abrasive industry are aluminum oxide and silicon carbide. Both of these, with the aid of intense heat, use common, earthy materials in the production of the rough grain that will eventually become some abrasive product familiar to us all. Here again, a systematic approach to an understanding of the abrasive industries becomes part of our ceramics program. Even though the natural abrasives like flint, emery, and garnet were formed by heat a long time ago by mother nature, we most certainly include them and their fascinating stories in our study of abrasives. Nature, until very recently, was the only producer of the much-used and valuable diamond. Now, man, through technology, has unlocked and duplicated nature's ability to perform this feat. A press has been produced that is capable of a hundred thousand atmospheres of pressure. This was the equipment that produced the first man-made diamond break-through. Just very recently, two Dutch scientists have been able to produce diamonds useful to industry, employing an explosive technique. This newest technique has great promise because it is easier to do. The transformation of a lowly bit or carbon to the diamond is an exciting addition most worthy of consideration in a ceramics program. In fact, the whole area of carbon ceramics, which is our twelfth area, is well enough defined and established to become still another area to study and understand for classroom interpretation. As such information becomes available to us, we include it in our program. The daily newspaper and outstanding publications like *Ceramics Industry* are the best textbooks available in a subject as dynamic as ceramics.

Newest Developments

Because ceramics is such a fast-moving and important field, we have seen the necessity of including a final category classified as Newest Developments. Here, the day-to-day changes in ceramics can be assimilated, if they do not already fit into a previously-recognized and established category. Lane K. Mitchell, in his fine little publication entitled *Ceramics: Stone Age to Space Age*, has an excellent section devoted to the fantastic new developments which already influence our society and very lives. Although comparatively new, the computer has undeniably become a significant factor in contemporary living. The so-called memory cells in the computer are in reality ceramic magnets or ferrites. These ceramic memories "serve to program an extensive series of operations for space flight, reactor control, and computation." New developments in capacitors, re-entry shields, plasma pitch devices, ceramic thermocouples, piezoelectric materials and many others, keep us hard-pressed, first of all, to understand and then to translate into meaningful classroom experiences.

Now just how is all of this done? As was mentioned earlier, change is not only necessary but painful as well. If you're willing to accept a little daily discomfort for the rest of your life, I'll offer the following suggestions for whatever they might be worth to you:

1. Accept the definition of ceramics in its broadest terms—the raw materials of ceramics are usually inorganic and non-metallic and there is *usually* a heat-treating operation in excess of 1100°F at some stage of processing.

2. Explore and identify your field of study. This is not easy and you will never be finished. Such work can be either inspirational, or complete and total frustration. *Let it be both*, and keep digging! By way of review, the following broad areas of classification have helped us handle what we recognize as the ceramic area:

1. Minerals, rocks and stones
2. Lime
3. Gypsum
4. Cement and concrete
5. Structural clay products
6. Whitewares
7. Glass
8. Glazes
9. Enamels
10. Refractories
11. Abrasives
12. Carbon ceramics
13. Newest developments

3. Exchange great depth in one or two favorite ceramic areas for an across-the-board approach. Being in the classroom, we will always be fighting the march of time. Accept whatever time is allotted to you and adjust your depth to whatever is possible, in order to cover the full scope of ceramics. If you had just ten minutes, you could tell the story of ceramics. Granted, it would be a different story if you had ten hours, or ten days, or weeks, or months, or years. Time is not an insurmountable obstacle. It would be impossible to ever tell the *complete* story of ceramics, so we recognize time as a limitation and adjust our programs accordingly.

Ceramics is many things to many people. It could be as simple as the pinch pot Johnny made for Dad, or as complex as all that has been mentioned (and not mentioned) in the last few minutes. From the preceding presentation, which revealed the scope of the ceramic industries, it is obvious that pinch-pot programs are woefully inadequate for industrial arts.

Just as the ceramic horizons for our technological society are unlimited, the ceramic programs in our public schools have their future before them, also with horizons unlimited.

Interpreting Industry in Industrial Education

RICHARD HENAK, *Industrial Education, Tecumseh Junior High School, Lafayette, Indiana*

THE "Interpreting Industry" course was developed on the following assumptions:

1. If the aim of industrial education is to teach about industry, the course should give an accurate picture of industry.

2. If a true picture of contemporary industry is to be conveyed, the industrial education course should resemble industry as closely as possible.

3. If the understanding of industry is important, the student should observe all of industry, not just the worker.

4. Early basic courses should provide content from which broad generalizations may be drawn rather than emphasize discrete facts about a few industrial materials.

5. A required course should have obvious usefulness to every student, boy or girl, bright or dull, college-bound or non-college bound.

Anticipated goals are: 1. Guidance for future life planning. 2. Understanding of goods-producing industries. 3. Show the interdependence of individuals and industries.

With these assumptions and goals in mind, the writer has developed the course to illustrate the goods-producing industries, those industries manufacturing the products demanding by our society. The organization of the course was adapted from the four functions of these industries, as identified by Jacob Sterner: research and development, planning for production, production (custom manufacturing and continuous manufacturing), and distribution.

As soon as possible the following outline was discussed with the class.

- I. Research and development
  - A. Product development
  - B. Product improvement
  - C. Material research
  - D. Product-equipment research
  - E. Pure research

- II. Planning for production

- III. Production
  - A. Custom (fixtures, usually one of a kind)
  - B. Continuous
    - 1. Mass (automobiles)
    - 2. Process (paper)

IV. Distribution
    A. Transporting
    B. Promotion
    C. Sales

V. Service
    A. Maintenance
    B. Repair
    C. Installation
    D. Consumer information

To familiarize the students with tooling and production techniques, the students operated a simple, serialized production-line setup by the teacher. They produced 2000 sweet corn skewers which were purchased by the class members with such enthusiasm that a limit had to be placed on quantities. The class also viewed the film, "The Factory—How Things Are Made," which provided the opportunity to follow the functions of industry in the production of a toy musical Jack-in-the-box.

Research and development: Each of the five classes then developed its own products in class discussions. Isometric sketches were developed to indicate details of construction. Applied research problems dealt primarily with the selection of materials and appropriate construction methods.

Planning of production: Stock in each company (class) was then sold. The companies were organized and individuals were given responsibilities within the patterns of company organization. Each company opened a bank account (the teacher was the banker) and handled all payments by check to acquaint students with financial transactions and to avoid the problems of handling cash.

Detailed planning involved the development of orthographic drawings to illustrate fixtures required for production. Other graphic communications techniques were used by students to develop production charts and plant layouts. Each company was involved in setting quality standards, safety standards, and production schedules.

Production: Production was presented as a custom production process in the construction of jigs and fixtures needed to manufacture the products. Mass production was illustrated and practiced in the actual production runs. Job-lot production was used rather than serialized production. This procedure appears to be more typical of modern industry, permits better utilization of equipment and manpower, improves quality control, offers more variety in product selection, and provides a better opportunity for evaluation of individual progress. A field trip to a local box board company was planned to show a process industry.

Distribution: Each company had a promotions manager who developed a bench-top display for Promotions Day and for use in the display window during the semester. A sales manager received and acknowledged orders. Since students from one class were able to order products from other classes, it was necessary to establish sales policies and for the purchasing agent to make out purchase orders to the other companies. When all orders were received and acknowledged production plans were finalized, and production schedules were set.

A shipping department was established to package the orders; a receiving department in each company received the shipments and dispersed them to the requisitioning students. The business manager kept a detailed record of all financial transactions. At the end of the semester companies were dissolved and the profits distributed to the stockholders.

Service: Repair and installation was not an activity in the course. Maintenance and consumer information was shown by packing a "finish maintenance" tag with the products.

Improvements: An opportunity might be introduced for one class to sublet a contract to another company for the production of parts. It is hoped that this would help illustrate the interdependence of industries. A recommended modification would be to have an open house for parents on Promotions Day.

Summary: The techniques used in this course—The Functions of Industry—may be effectively undertaken in many areas. The content would remain basically the same, whether the course was conducted in a laboratory equipped for woodworking, graphic arts, plastics, or metal working. In addition, the content should meet the general educational goals of industrial arts for girls.

A course in manufacturing would appear to be highly desirable for a student who can schedule only one industrial education course. The broad perspective provided would appear to be far more beneficial than a hand tool course in working one material or a beginning drafting course. The content and method used in this course seemed to meet the objectives of understanding industry quite effectively without slighting other objectives.

A great deal of success has been experienced by the writer in the form of student satisfaction and enjoyment, interest from other departments within the school, interest of the administration, parental acceptance, and interest of others in industrial education.

Detailed Course Outline

The detailed course outline includes both detailed course content and the types of activities engaged in by the students. Individual responsibilities are reported both orally to the class and written to be handed in for evaluation.

The goods-producing industry transforms raw materials by factory methods into things wanted by society.

I. The Nature of Goods
  A. Raw material industries (farming, logging)
  B. Semi-manufactured (lumber, yard goods)
  C. Finished goods
    1. Producer goods (used in manufacturing)
      a. Durable—machines
      b. Semi-durable—saw blades
      c. Non-durable—sandpaper and fuel

- 2. Consumer goods used by the people
    - a. Durable—kitchen stoves
    - b. Semi-durable—clothes
    - c. Non-durable—paper towels

II. Functions of Industry

- A. Research and development (R/D)
  - 1. Product development
    - a. Identify product (group)
    - b. Analyze product (group)
    - c. Tentative sketches (individuals)
    - d. Final sketch (individuals)
    - e. Build model (teacher)
    - f. Evaluate model (group)
  - 2. Product improvement
  - 3. Product equipment research (discuss)
  - 4. Material (discuss, individually if necessary)
- B. Planning for production
  - 1. Cost accounting (group)
  - 2. Accumulate capital (group)
  - 3. Form corporation (group)
  - 4. Select methods (group)
  - 5. Select equipment (group)
  - 6. Design fixtures and jigs (committee)
  - 7. Set time standards (individual)
  - 8. Set quality standards (individual)
  - 9. Design safety features (individual)
  - 10. Set production (group)
  - 11. Select personnel (teacher)
  - 12. Training personnel (teacher and individuals)
  - 13. Purchasing materials (individual)
  - 14. Plant layout (committee)
- C. Manufacturing
  - 1. Custom
    - a. Fixtures (individuals)
    - b. Jigs (individuals)
    - c. Advertising models (teacher)
  - 2. Continuous
    - a. Mass
      - 1. Job lot (group)
      - 2. Serialized (group)
    - b. Process (field trip)
- D. Distribution
  - 1. Promotions
    - a. Advertise (committee)
    - b. Market research (teacher)

2. Sales
   a. Sales policy (group)
      1. Pricing
      2. Commissions
      3. Discounts
   b. Receive orders (individual)
   c. Set production (group)
   d. Answer inquiries (individual)

E. Service
   1. Maintenance (discuss)
   2. Installation (discuss)
   3. Customer instruction (teacher)
      a. Care of finish
      b. Cleaning
   4. Credit (discuss)
   5. Guarantees

A Conceptual Approach to the Study Of American Industry

WESLEY L. FACE, *Associate Professor of Industrial Education, Stout State University, Menomonie, Wisconsin*

EUGENE R. FLUG, *Assistant Professor of Education, Stout State University, Menomonie, Wisconsin*

SINCE the introduction of industrial arts as an area of study, many proposals have been made to change its content. Curriculum planners have variously viewed industrial arts as (a) the study of life needs created by technological advance; (b) the study of tools, materials, processes, and occupations of industry; (c) the study of the applications of mathematics and the sciences to the solution of technical problems, and (d) the study of industry.

This is a progress report of an experimental program that falls into the latter category. It is not proposed as another course such as Drafting I, Cabinetwork II or General Shop III. Its content is selected to develop an understanding of the institution called industry; its approach attempts to develop concepts. It is called *American Industry*, not merely to coin a new name but to differentiate it from other proposals.

The program is experimental. Two years of faculty discussion at Stout

State University, a study carried out on a planning grant from the U. S. Office of Education, and a summer workshop for teachers financed through a grant from the Ford Foundation have developed it to its present stage. Ten teachers in eight schools tried it out in the school year 1964-65.

Objectives of the Study

The objectives for the program in American Industry have grown from a careful study of previous statements of the purposes of American secondary schools.

An early statement of objectives by the Commission on the Reorganization of Secondary Education proposed the well-known seven cardinal principles. In 1938, the NEA Educational Policies Commission reduced these seven cardinal principles to four: self realization, human relationship, economic efficiency, and civic responsibility.

Acceptance of these broad goals, dipping into every facet of human life, has led the schools to assume many responsibilities that were formerly considered the domain of other institutions in our society. While the public has come to recognize that the schools must consider all these factors, they have also shown a growing concern that the primary mission of the schools not become obscured.

As a result of this concern, the Educational Policies Commission, in 1961, isolated the central purpose of education as the development of the rational powers of man. The Commission clearly stated that this is not a unique contribution of education, nor is it the sole purpose. It represents, rather, an attempt to convey the idea that the rational powers are central to all other qualities of the human spirit.

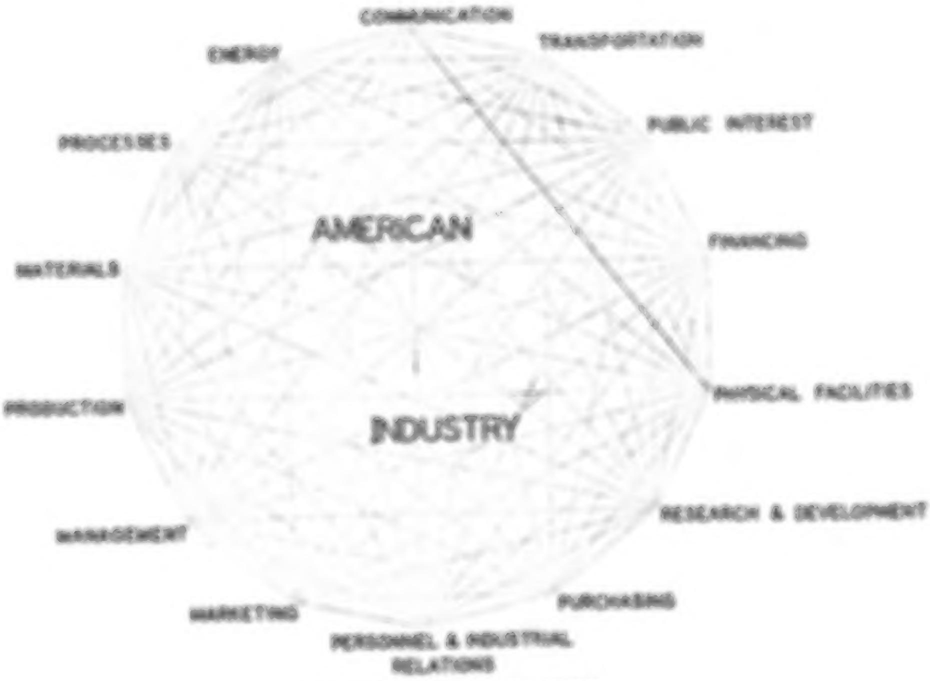
A corollary of this central purpose lies in the responsibility of the schools to acquire, preserve and disseminate that knowledge which has been developed and refined by the human intellect and which interacts with man's environment.

The broad objectives of the American Industry program were derived directly from an acceptance of this clarified purpose of education. They are (a) to develop an understanding of those concepts that apply directly to industry, and (b) to develop the ability to solve problems related to industry.

The emergence of technology as an ever more potent force in the molding of society appears to justify the inclusion of a study of industry in the public school curriculum. The problems of the future are inseparable from increasing industrialization, and young people must be led to an adequate understanding of these forces that impinge on their daily lives.

Structure of American Industry

The recognition that content taught in the typical industrial arts shop is basically lacking in coherent structure led to what is regarded as one of the primary strengths of the program of American Industry. The typical industrial arts offerings have been based upon an analysis of selected trades in order to identify specific manipulative operations and related information. The program of American Industry, on the other hand, is based on an approach that attempts to identify basic concepts common to a variety of industries.


COMMUNICATION
TRANSPORTATION
PUBLIC INTEREST
FINANCING
PHYSICAL FACILITIES
RESEARCH & DEVELOPMENT
PURCHASING
PERSONNEL & INDUSTRIAL RELATIONS
MARKETING
MANAGEMENT
PRODUCTION
MATERIALS
PROCESSES
ENERGY
AMERICAN
INDUSTRY

THE STRUCTURE OF INDUSTRY

Structure, as used here, simply refers to a unified, basic description of the several facets of industry as found in contemporary American society. Industry is conceived in this structure as consisting of several major areas, each of which is further subdivided into still smaller units. Industry, for the purpose of this project, is defined as *an institution in our culture which, through the application of knowledge and the utilization of men, money, machines, and materials, produces goods or services to meet the needs of man.*

The accompanying figure, "Structure of Industry Showing Major Concepts," graphically presents this process of analysis.

The breakdown does not stop here; it continues to still smaller units, until the ultimate goal—a minor concept—is reached. It should be emphasized that each level, division and subdivision represents a concept—something to be studied for understanding.

The fourteen major concepts of American Industry have been defined as follows:

Communication—The acts of conveying thoughts or signals between points in coordinating the operations of industry.

Transportation—The acts of conveying physical objects between points to facilitate the operations of industry.

Public Interest—Those activities of industry which are primarily concerned with the protection and enhancement of man's existence.

Financing—The procurement and control of the funds needed to establish and maintain an industry.

Physical Facilities—The more permanent tangibles which are necessary in producing a product or in the rendering of a service.

Research and Development—Those activities concerned with the designing of a product or service to meet the needs of man.

Purchasing—The locating and procuring of the materials, physical facilities, and services needed by industry.

Industrial Relations—The coordination of the relevant associations of those directly involved with industry and those not directly involved, in order to promote the best interests of man and the organization.

Marketing—Those activities intended to bring together the consumer and the products or services of industry.

Management—The guiding and directing of all industrial activities in the most efficient manner.

Production—The combining and operating of those elements of industry necessary in the making of salable goods or rendering of services.

Materials—Those substances which are transformed into salable goods or utilized in the performance of services by industry.

Processes—The systematic series of actions involved in the transformation or utilization of materials in the production of goods or services.

Energy—The controlled forces which are utilized in industry.

It must be stressed that this structure, unlike those of many other proposals, attempts to categorize understandings rather than specific industries, materials or occupations. Thus, understanding of concepts derived from this structure would be universally applicable in any specific industry which encompasses it.

The Conceptual Approach

The increasing complexity of this technological age, leading to massive accumulations of knowledge, has made untenable the atomistic approach to the development of teaching content. It must be recognized that the dynamic nature of knowledge makes continuous demands for changes on the part of man. While specific knowledge tends to change rapidly, broader concepts are more stable, although it must be admitted that even concepts may change in time. The concentration upon the acquisition of concepts rather than the emphasis on specifics should, however, enhance the possibility of retention, transfer, and application of knowledge to new and different situations.

After a rather exhaustive review of the literature on conceptual learning, the following definition of a concept was developed for the purpose of this project. A concept is *a psychological construct resulting from a variety of experiences (detached from the many situations giving rise to it), fixed by a word or other symbol, and having functional value to the individual in his thinking and behavior.* Since concepts are the materials and tools of thought processes, most scholars in this field would agree that they are the most precious products of the educational process.

Concepts may be grasped at all levels of understanding from concrete to abstract, from vague to clear, from inexact to definite. Because of the wide range of understanding possible in the process of developing concepts, this program is cognizant of the variance of individual differences in students. One student may have a very low level of understanding of a given concept and another a much higher level. The important consideration, however, is that they both have understanding.

Frederick J. McDonald writes of two types of concepts. Informal concepts are seen as those which man forms independently and haphazardly as he interacts with his environment. Formal concepts are identified as those which the school systematically attempts to develop. The task ahead lies in identifying the formal concepts which will complete the structure of industry shown in the figure.

Before the student can progress in the development of a broad concept, he must have a basic system of concepts built upon previous experience. Without this background to draw upon, he will find it difficult if not impossible to categorize the various processes presented. Secondly, he has to react to the material presented; it is necessary for him to take an active part in the process.

This point deserves further emphasis. The need for active participation in concept formation is repeatedly stressed in writings on the subject. The nature of the activities required varies in accordance with the learner's degree of sophistication in the subject matter under study. In the early stages of the acquisition of new concepts which are quite different from the experiential background of the learner, direct involvement is essential. For this reason, the industrial arts laboratory has been chosen as the place in which to introduce the study of industry.

Basic to concept formation is the role played by the senses in perceiving objects, events, and attributes. John A. H. Keith pointed out the abstract nature of a concept developed through perception but rooted in reality: "The concept is not cut off from concrete reality, it is simply the mind's way of thinking the many into one, or as philosophers say, finding unity in variety."

The Program as a Replacement

As stated previously, the evolving program of American Industry is not envisioned as merely a new approach, or addition, to present industrial arts offerings, but rather as displacing the traditional programs in the secondary schools. The thinking of leaders in the field as expressed in professional publications and convention proceedings, in addition to personal observations of the writers over the past ten years, has brought a full realization of the need for a drastic reorientation. Model practice in industrial arts reflects a lack of logical consistency growing out of a variety of educational philosophies.

Up to This Point

It is expected that during the pilot study a great number of questions will emerge. As these questions are identified, further study and experimentation will seek answers. It must be re-emphasized that the program is still in the developmental stages; however, the project staff is confident that the basic rationale provides the needed direction. Whether or not it meets full acceptance, all those involved in the project are proceeding with the exhilarating feeling that they have accepted the challenge of defining the discipline represented by American Industry.

Beginning (Junior High) Metal In a Small School

BRYCE D. MARCH, *Southeast Missouri State College, Cape Girardeau, Missouri*

CONTRACT grading, a teaching technique in industrial arts courses, makes work in the shop more realistic for the student and aids the teacher in assigning grades.

The student plays the role of a contractor while completing a job or shop project. He finds that the results in his project, just as those in industry, are evaluated not only in quality but also in terms of labor time costs.

This system—which finally results in a grade—has been proved in junior high industrial arts metalwork in small schools. The plan helps motivate students. They become involved in setting time standards for their work, they understand how their grades are arrived at, and they learn to appreciate the value of time. This leads to a plan of procedure for one of the factors that will give every learner the opportunity to advance according to his potential.

Perhaps no standard time for the job is on record, especially when students propose individual projects of their own design. Then the instructor and student can agree on a contract time beforehand by consulting standards on record for similar jobs.

Before starting a project, the student gets a form on which he can record the actual working time with dates, time allowed in hours for the contract, and the actual time used. In fact, the suggestion is made that he can divide the actual time used by the time allowed and obtain a percent for his personal efficiency.

To teach industrial arts is to provide an introduction to industry, and to do so should include experience with contracts for construction jobs.

As an example, when classes change on the hour and there is a period of five minutes passing time, five to get underway, and five to clean up, there is an actual 45 minutes work time per period. For a six-week reporting period —meeting every day for 24 periods—there are 18 work hours (less the time in which informational content is taught, etc.).

An *A* is 4 points; *B*, 3; *C*, 2; and *D*, 1. An average work rate with average quality work would render 2 points per work-hour or 36 points for a *C* in the reporting period. The *D* would require 18 points; *C*, 36; *B*, 54; and an *A*, 72 points.

As each project or item is completed and the grade is recorded, the time contract in hours is also recorded with the grade. The actual time to complete the project can be recorded in a separate column in order to account for the total time.

An example could include:

	Cold Chisel	Metal Box	Lamp	Welding Practice Pieces	Total	Grade
Bryan						
Contract Hrs.	1	2	8	5	16 hours	
	C	*D*	*A*	*B*	51 points	*B*—
Actual Hrs.	2	2	9	5	18 hours	

A simple averaging of grades would have produced a less meaningful C+. The student can readily note that his work met only 16 "contract hours" in the 18-hour span. He can note on which jobs his slow working showed up. This, of course, helps in the realization of the value of time, accounting for both quantity and quality.

Advanced Metal in a Small School

JOE HEATON, *Industrial Arts Instructor, Alva High School, Alva, Oklahoma*

INDUSTRIAL arts is obligated and responsible for student development, not only in basic metal experiences and technological understanding, but also in understanding of production organization methods, techniques of mass production, and duplication. Personnel organization practices, financial and protection coverages, and union conditions are also our responsibility.

We are falling short in our responsibility to educate our students to the world in which they live. We are presenting basic experiences with materials, teaching technological terms, and delving into vocational training where our own experience and interests are strong.

Industrial arts teachers usually have neither the current experience nor the trade background to qualify as vocational instructors, but we do not profess to be vocational teachers and should not feel apologetic or ineffective because of this lack. Our objectives are not technical details or vocational proficiencies. Our aims are those of general education as it relates to industrial arts.

We need to be sure our students, who may never serve in a vocational occupation, gain understanding of a broader scope and an over-all picture of the field. At times industrial arts teachers tend to ape the vocational instructors and bury their students in details specific to a particular area of the trade. The teacher spends much time on tools and machine techniques that are pertinent only to a particular brand of tool or machine that is already out-dated in production.

We complain that good students that should be in our classes are lost to the other academic subjects, but in many respects we are to blame because we offer only vocational training and not general understanding of principles and techniques. We emphasize tool skills and basics but do not reveal the over-all pattern of production or the possible potential uses of these skills and basic techniques.

Our advanced program, whether in metals or some other area, needs to challenge the student who doesn't look for trade training but is interested in industrial development practices. Many more people are employed as related personnel to an area trade than are employed as skilled tradesmen . . . . Successful metal fabrication requires many more skills than just technical understanding. Our advanced metals courses should and could satisfy this need without expenditure for expensive equipment.

Simple machines used in basic metals could be adapted to provide experience in production set-ups, if we as teachers recognized the need for such classes and acquainted ourselves with the information necessary. Our college departments need to make the necessary research in industry as a whole so that we as trained teachers could proceed with such a program.

Advanced metals in small and large schools alike needs to be taught in such a manner that our students receive a better understanding of production methods, so that the human potential of each student can be recognized and expanded to the heights of his desires in any part of the vast area of metals production.

Advanced (Senior High) Metal In a Large School

J. C. BRUECKMAN, JR., *Assistant Professor, New York State University College at Buffalo*

COINCIDENTALLY, the topic of the special interest groups is very similar to our New York State University motto, *"Let Each Become All He Is Capable of Being."* In a similar comparison, significant coordination is indicated between national programs and our statewide policies. Assuming that the student is receptive to a program which will develop his potential, we see a need for a comprehensive course of study which will meet this challenge.

In the field of metalwork, we coordinate student ability with generally accepted basic units of study. This coordination should develop to the point of challenging every ability and interest level.

Assuming also that this program will incorporate about 150 clock hours of instruction and laboratory experiences in a year, we would divide such a program, for clarity and expediency, into seven arbitrary units: Applying and producing, shaping and cutting, joining, machining and forging, casting, finishing, and heat treating and testing.

If we then consider the make-up of each area of instruction, thinking in terms of applications of specific topics with concern for varied responses of students, we should then see the development of potential through the industrial arts metalwork curriculum.

As an example, presentations concerned with iron and steel production through typical audiovisual means can be supplemented for the unchallenged student with a group or team problem-solving technique of producing iron with a thermit or the basic oxygen process. Study of occupations in this unit becomes more meaningful when we are able to refer the student to the government publications available in most school guidance offices, and expose them to the complete employment and educational prerequisites records.

In the area of cutting and shaping, we include bench metal techniques and hand operations. However, if we are truly interpreting industry, the many facets of this unit must be considered. The metal-spinning technique offers some challenges, but do we fail to consider other types of industrial forming and cutting, such as blanking, piercing, drawing, explosive and pressure forming, which can be adapted to a school lab? Without extensive supplementary equipment, we can adapt the common arbor press to perform many of the aforementioned operations.

Presenting the joining of metals unit, we have seen some students overwhelmed by the demands of soldering and riveting. However, they were motivated to enter national competition in welding contests because of a unique interest or a more-than-typical application of welding techniques. These experiences can have an overlapping effect in other subject areas in the school because of the required procedures for procedure write-ups, technical drawings, and descriptive photographs.

Concerning machine shop practice and forging techniques, bear in mind that the student who computes the tapers, spindle speeds, or index patterns could be interested in programming tapes for automated machines a possibility of enrichment. On the other hand, the student who can be interested by performing repetitious machine manipulations, carefully-prepared maintenance operations, or other individual assignments, will make a positive contribution to his educational growth if he understands the importance or relevance of these performances.

Casting is one of the most rapidly-growing and changing areas in the field of metalwork. Although many of the green sand techniques are basic to other forms of foundry work, industry puts greater emphasis on precision investment, shell molding, and die casting. If we fail to incorporate the preparation of sand shells, consumable plastic patterns, and centrifugal casting procedures, we may be overlooking operations which will advance student learning and progress.

The area of finishes also continues to develop and with it a need for further experimentation with school lab applications. We have seen decorating and coloring performed in labs where the compounds were significant because of the student involvement in the preparation of the chemical agents. Other applications could include metalizing, wrinkle and hammer effect finishes, plating and anodizing, in keeping with the contemporary development of metal products.

Testing is probably the most overlooked unit of our course of study simply because of the need for expensive equipment with limited purposes. However, school suppliers are overcoming this limitation by making practical testing equipment available at a reasonable price.

Whether we contrive our own equipment or procure it through other means, the testing of materials is one of the most challenging and interesting units to the students. We have seen the study of metal production enhanced through beginning metallographic techniques, non-destructive testing—e.g., spark testing and destructive testing—demonstrated with the basic scientific school equipment which circumvented the need for unavailable expensive equipment. These simple beginnings not only furthered student interest but also gave impetus to the development and purchase of more complex equipment for the metals lab.

The dedication and initiative of the instructor is the primary factor in determining the degree of "potential development," regardless of the complexity of lab equipment or the uniqueness of the total school facility. The instructor not only has to recognize individual differences, but must react to these differences by guiding the student along creative paths of learning.

Beginning Electricity-Electronics In a Large School

JAMES C. DURKIN, *Coordinator, Industrial Education, East Cleveland Public Schools, East Cleveland, Ohio*

FIVE years ago, a concerted effort was initiated in East Cleveland, Ohio, to construct a curriculum for industrial arts that would deal directly with contemporary content, one that considered individual differences and provided an educational environment that would allow students to develop their unique potentials to the fullest.

A team of industrial arts teachers took up the challenge and expended considerable effort in evaluating the potential of such a change. The studies were culminated in a prospectus that gained support from the East Cleveland Board of Education and opened the way for a series of significant changes. These included the progressive elimination of traditional industrial arts courses and the emergence of a curriculum based on a conceptual study of technology.

While course names are easily changed, content tends to remain stagnant. In the realization that much of the recent revision was simply a reshuffling of a stacked deck, considerable attention was given to fresh and creative approaches to the curriculum development. This insured that the content would be consistant with the new approach and would not fall prey to the so-called time-tested fundamentals.

The road was difficult to travel because people naturally resist change, but change does come, and with it a new awareness. As one changes his vantage point, a clearer perspective of the issues can develop. Eventually the critics begin to lose their arguments. "It can't be done," "It won't work," "No one has ever done it before," are no longer valid statements. It has become obvious that the new curriculum cannot be achieved by those standing on dead center. It can only be done by those who have ventured into the frontiers of education, have conducted the experiments and gathered the data. Through their enlightenment they alone can identify the advantages and disadvantages.

During the intervening years, five areas have emerged in our industrial arts curriculum: power technology, manufacturing, graphic communications, construction, and industrial science.

Courses in woodworking, machine shop, and after this year, mechanical drawing, have been phased out, with more to go. The changes were started at the high school level and are extending into the junior high and eventually to the primary grades. The new curriculum fulfills needs at all levels, for all students.

A brief explanation of the courses will set the stage for future remarks. The area of *power technology* is the study of the transmission and creation of power. The *manufacturing* sequence is the study of non-repetitive and continuous progressive manufacturing. *Graphic communications* is the study of communications by graphic media. *Construction* is the study of structural design, fabrication and erection. The *industrial science* area includes an electricity-electronics sequence consisting of basic electricity, vacuum tube and transistor electronics, industrial circuits and digital circuits. Completing the industrial science area is research and development as the study of the investigation and implementation of new knowledge.

With the foregoing to serve as a synopsis of some of the events that have influenced my thinking, I offer the following observations—based on my role as a coordinator of change, on virtually living curriculum change for several years, and on the battle scars, the breakthroughs, the setbacks and the achievements that are a part of change: The student is the central consideration in curriculum development. I will discuss why he should learn, how he can learn, what he should learn and what kind of educational environment will allow him to learn.

The student enrolled in junior high school today will conclude his public education about 1970. If he elects to continue his education or training, his role in life will start to develop around 1975. By 1985 he will have started his family, changed employment a few times and will probably be in need of some re-training or re-education. During his mid-forties he could conceivably hold a position with a job description so different that we could not understand it today. Soon after the year 2000, his grandchildren will be in school, a school so different that our educational centers would look feeble in comparison. By the year 2015 he will be enjoying some form of retirement in a world quite different from that which we know. What fantastic changes will occur in the next fifty years! How can we educate him *now* to best serve him in the future? What knowledge will serve him best?

Civilization has accumulated and recorded much of the knowledge of the past. The past has traditionally served as guide lines for the future. But today with the knowledge explosion so vast that in this century, more information was recorded than all the centuries before, the student must be aware more and more of what is new and less and less of what is old.

The knowledge explosion is not so surprising when one considers some of the reasons. Ninety percent of the scientists the world has ever known are living today. At their disposal is a vast array of media for recording and circulating their accumulated discoveries. In the next ten years our storehouse of knowledge will double. Much of what is standard knowledge today will be submerged into history. This identifies an important point: Specific facts tend to become obsolete.

Time has become a commanding force that demands recognition along with the acquisition of new knowledge. The speed with which information can be obtained has far exceeded the capabilities of man himself.

The computer, born of our generation, has done much to accelerate the pace. To illustrate this rapid growth pattern, consider the task of multiplying two ten-digit numbers. By hand, it requires about seven minutes. With a desk calculator, two such problems could be worked in a minute. When the first vacuum tube computer was originated in 1950, some 20,000 such problems could be processed in a minute. A considerable savings in time was realized. The second generation of vacuum-tube computers increased the rate to 430,000 problems a minute, just five years later. By 1960, the new solid-state computers could proceed at the rate of over 2 million problems in the same 60 seconds. Today microelectronic computers can exceed 21 million calculations in the same time period. But more astounding yet will be the second generation microelectronic computers that two years from now will work in the neighborhood of 220 million calculations.

When the Educational Policies Commission published a document titled "The Central Purpose of American Education," they chose to conclude their commentary with this profound statement: "Man has before him the possibility of a new level of greatness, a new realization of human dignity and effectiveness. The instrument which will realize this possibility is that kind of education which frees the mind and enables it to contribute to a full and worthy life.

To achieve this goal is the high hope of the nation and the central challenge to its schools."

This, too, is our challenge.

Thus, developing in students the ability to think and think rationally is our primary concern as educators. This responsibility does not change according to one's certification. It is not more important in a mathematics class nor less important in an industrial arts class. It is as much the responsibility of a beginning teacher in a primary school as it is of a professor in a university. It is central to all other purposes in education—and it is central to industrial arts education.

Therefore, our primary responsibility in industrial arts is to produce an education environment that will give every learner the opportunity to advance according to his potential by the development of his rational powers—his ability to think. Civilization has progressed only because man has been capable of increasing his knowledge. He is therefore a producer of information, a creator of knowledge. A student who thinks rationally has the capability of producing knowledge.

Education should be structured in such a way that the students participate in the identification, analysis, and documentation of their newly-discovered information. This would be knowledge discovered by the students on the frontiers of their experiences. Too often the students are placed in the role of observers while the teacher participates in the act of demonstrating. Quite often this leads him to discover new knowledge for himself. Why then must the students serve only as an audience? They too have the capability to discover.

Paul Hanna pointed out that "In our modern view, we hold that knowledge may be established in at least three ways: (1) Knowledge may be *revealed*, as the Ten Commandments were to Moses; (2) knowledge may be *discovered*, as it was by Galileo when he used his telescope and found the four moons of Jupiter; (3) knowledge may be *created*, as Einstein did in giving the modern world the advanced theory of relativity."

Knowledge in our time stems primarily from the ability of the brain to discover and eventually to create. To hinder the student's chance of discovering knowledge for himself by using antiquated teaching methods is to shackle the student's right to develop his rational powers and to minimize his chance of creating new knowledge. That is in contradiction to the central purpose of education itself.

It is important that while the student is acquiring knowledge that he also becomes aware of the unity of knowledge. With the accumulation of knowledge the student must learn to seek and identify the structure that gives unity to knowledge.

This structure will be significant as he extends his creative power to new situations. His ability to recall his past knowledge to aid in solving new problems is increased if he has formulated a structural pattern for classifying information that can readily reveal relationships. The structural organization will also allow new information to be easily classified. The unity of knowledge will provide the student with the ability to distinguish what knowledge is of most importance to him and relinquish to limbo that knowledge which becomes trivial. Thus, knowledge that is lasting must be conducive to change; and change today must be thought of as continuous, not as occasional.

In what form can we as educators mold our subject matter and course content to give it lasting quality? How can we help the student build a foundation strong enough to last his lifetime? As was stated before, specific facts tend to become obsolete. Therefore, emphasis on details must give way to more lasting factors.

Concepts or simplified summations of unified knowledge have lasting power. Concepts can grow and change with the acquisition of new knowledge. I therefore suggest that the content we deal with in industrial arts should be conceptual in nature. This will require looking at the knowledge we now possess in terms of the broader implications and relinquishing our grasp of stereotyped truths and laws.

To illustrate this point, I will refer to the typical thinking employed when a project under construction in an industrial arts class requires a hole drilled in one of the parts. The fact that the stereotyped statement, "a hole drilled," is used points out the narrowness of the framework within which student are forced to confine their thinking. While one hundred years ago, drilling or punching were virtually the only processes by which a hole could be produced, today the number has increased to well over thirty available processes. Drilling a hole is a specific act subject to obsolescence. Today we must think in terms of generating a hole. This is a concept that grows stronger as more and newer processes are added.

Today a hole can be generated in an object by a host of alternatives: punching, boring, chemical milling, and flame cutting are processes that are readily recognized. Electro-discharge machining, laser beam, ultrasonic machining, and plasma jet may not be as well known, but all are capable of generating a hole. Consideration must also be given to producing the part with the hole already there. Laminating, sintering, and injection molding, to name a a few, are processses that produce the hole and eliminate the need for some of the aforementioned processes. The concept "generation of a hole" now provides unity to many isolated facts or minor concepts. One could easily fill in the other thirty or more processes that relate to this concept by searching his mind or conducting some research. When the day comes that we no longer generate a hole by drilling, and that day will come, the concept itself will still remain, made even stronger by the new knowledge acquired in the future.

The development of concepts from the unification of knowledge that students have discovered or created will provide simplicity to learning and will aid in the development of his rational powers.

If formulating concepts will aid the student's education, what concepts should be indentified in industrial arts and, more specifically, what concepts are of most importance in electricity and electronics?

Sir Julian Huxley made the following observations dealing with the field of communications: "Seventy years ago the term communications would have dealt with high speed newspaper printing, typewriters, photographs and lastly the wonders, using the new field of electricity, the telegraph and the telephone.

"Now the terms communications and control are used together. The reason for this is that communications and control are no longer separate subjects.

"Communications used to be man to man; now, however, unless we make up a new word, it must come to mean communications are how man and machines inform each other.

"It now becomes apparent that no medium of communications can stand by itself. Cross-fertilization has yielded mongrels, mutations and hybrids that include xerography, computers, Telstar, photolithography, television and maser."

Since Huxley made those observations, new discoveries have surely added validity to his statements. At the same time, however, his comments seem to become rather conservative.

All that has been said here today and much of what has been said at this convention bears out the significance of the technology of communications and its importance to our very existence. Here, then, is an area of the industrial arts of the future, communications technology.

Courses that we have known as individual entities will advance and consolidate to form dynamic areas of vast significance. Coupled with unity of knowledge and stated in a conceptual manner, what would have seemed staggering in proportion can be unified as an organized body of knowledge.

In the interim period, what we know as mechanical drawing will evolve through drafting and technical drawing to combine with graphic reproduction, as it also evolved from printing and graphic arts. Together they will form graphic communications and await the merger of electricity and electronics with cybernetics. When all areas have combined, communications and control will be unified as the organized body of knowledge identified as communications technology.

Now, to explore the central concept in communication technology, the concept of the communicative process itself: Information in some form is recognized, it can be the awareness of information or the awareness of the need of information. Next comes the process of encoding with a suitable symbol. The symbol is then transmitted through an appropriate medium where it is received and eventually decoded. The receiver then must interpret and attach some meaning to the symbols received. If the receiver can communicate back to the sender, then feedback or a control loop is created, characteristic of two-way communications. Difficulties in communications are present when barriers to the encoding and transmitting or receiving and decoding are present. The presence of unwanted media also adds to the confusion.

In specific circumstances, the concept varies but the interrelation of the elements is basically the same. Consider at your leisure how elements such as printing, drawing, machine controls, electronics, and people themselves fit into the communicative process.

In closing I would like to reiterate: (1) the central purpose of education is to develop the rational powers of man, his ability to think. (2) knowledge can be obtained three ways: by revelation, discovery, and creation. (3) students at any age are capable of both discovery and creation of knowledge. (4) the unity of knowledge makes recall and transfer simpler. (5) the interrelationship of knowledge can be structured through concepts.

Advanced Electricity/Electronics in a Small Senior High School

KENNETH L. SCHANK, *Consultant in Practical Arts, Racine, Wisconsin*

To consider the problem of providing maximum learning opportunities for all students according to their individual potentials through the media of electricity/electronics, a number of factors should be reviewed.

Consideration in terms of meeting the needs of individuals should be given to the following items: class and school size, pupil and community goals, teaching methodology, industrial arts curriculum, equipment and facilities, and last but not least, financial support.

The opportunities for offering advanced E/E in a small high school present a number of challenges to administration and teaching staff. A unit shop in E/E would probably not be found in a high school of less than 750 with a likelihood that the school population would have to be closer to 1000. Wood, drawing, and metals seem to be the predominant offerings, with E/E and power mechanics nearly tied for fourth place. It is therefore quite likely that E/E would be a part of a general shop offering or a shared shop activity if the school had less than 1000 students. The size factor does influence the possibility of offering specific kinds of programs in E/E. It is quite likely that class sizes, in an elective course of this type, would remain small, thus allowing for greater pupil-teacher communication. It is important that small classes be arranged in an advanced course so that the instructor can spend enough time with each pupil as he pursues his problem to really guide him.

We might next consider the pupil's goals and those of the community. Perhaps a large number of the students go on to college with a future planned in a profession such as engineering. There might also be some who will go on to technical schools with a definite E/E job in mind. There are those who might elect an advanced E/E course, with high school graduation as the termination of formal education, who will immediately seek employment in a local industry. The course offering must then have the factor of flexibility to meet the goals of each of the pupils. If we accept the philosophy that learning never stops, we should then provide background for each pupil to enable him to change goals with a minimal amount of lost time. Whether the goals of the pupil seem to be short-range or long-range, there must be enough latitude so that individual needs are met. Community goals might be those of preparing an adequate labor force for local industry or it might be that of encouraging each individual to pursue his own interests and talents.

There are a large number of teaching methods, but for the sake of brevity we will place them in two major categories. One method is the "traditional," consisting of textbook, lecture, demonstration, required project. It provides the least opportunity for individual development, limited broad interest, or creative experimentation. The alternate method is at the other end of the spectrum and is commonly known as research and experimentation.

We must assume that the student enrolling in an advanced course in E/E has had the preliminary experiences in junior high school, or has had an introductory course wherein he acquired the factual foundations of magnetism, electrical production, circuitry, machines, measurement, capacitance, inductance, resistance, and has a fair understanding of vocabulary.

Assuming we want to balance theory with practical application, we want to draw on both methods to teach E/E. We want to keep in mind the relationship of science and mathematics to the world of industrial technology. Our goal is to meet the needs of each individual by supplying him with the tools—knowledges and skills—to fulfill himself. One such tool is communication, oral or written. A seminar approach to E/E will provide a means of developing the student. The student can acquire the fundamental E/E information and then have the guided experience of research and experimentation. There can be a give-and-take situation of either student- or teacher-suggested projects. In this way the skills of problem-solving can be developed. The points might be problem identification; data collection, tentative solutions, feasibility, selection, development, experimentation, confirmation of solution, and evaluation. Not all students will be interested in producing an original electrical or electronic device but would rather run performance-reliability tests on pieces of equipment. At this point an advanced course in E/E might be rewarding for the student who is less creative or less able. He might find real satisfaction in a routine testing procedure of components, or apparatus under varied conditions.

What is the relationship of an advanced E/E course to the total program of industrial arts in the small high school? All areas should complement one another and form a total program for each pupil. The areas of drafting, metals, wood, plastics, graphic arts, and power mechanics have certain common grounds and areas of overlapping interest. The rapidly changing technology points out the interlocking interdependence of areas of work. There is hardly an industry that doesn't become involved with E/E and so a two-pronged approach will have some appeal to some students. Automation, quality control, and testing are but a few of the related applications. Why not then provide opportunities for students to make joint applications of E/E and another industrial arts area of interest? Consider the wide potential of E/E to the area of power mechanics. There are applications for safety, testing, and closed-circuit systems, to name but a few. The projects do not necessarily have to be "take home" projects, but rather build-up and take-down laboratory experiments, or even pieces of test equipment which can remain permanently in the school for future students to pyramid their work.

Next we can consider equipment selection and facilities. We should first consider whether we are establishing a new program, or revamping an old E/E situation. There are a number of avenues open.

Some suppliers have complete packaged programs of E/E available on the market which contain books and a wide variety of equipment including demonstration units for the instructor as well as the student.

Equipment, or the lack of it, often predicates the type of program taught in E/E. An extreme shortage would probably force a lecture-demonstration program with limited opportunity for real student participation. This would tend to keep all pupils equal and provide little or no possibility for individual differences to be recognized. Of course there is the potential for developing a high degree of resourcefulness on the part of the teacher as well as the pupils in acquiring suitable materials with which they could carry out an advanced E/E program. It is likely that a high student interest in a research and experimentation E/E program would serve as a motivational factor in their finding sufficient materials to operate. The teacher's experience in anticipating overwhelming problems and steering the pupil into another channel where possibilities for success are more nearly possible is something to consider also. This is not to intimate that success every time is the only way to learn. Supervisors and administrators are sometimes appalled at the "pack rat" tendencies of E/E teachers. They seem to have an affinity for old radios or TV sets which they methodically cannibalize. Their eyes light up at the sight of government surplus transistors, capacitors, choke coils, or a tangle of resistors. They know the value of each item and are sure it will be used, sooner or later. The availability of these pieces of equipment might make the difference between success or failure for some student.

The problem of operating funds or capital outlay to get an E/E program started is not easily solved. An early decision is whether a packaged program should be attempted, with new units added each year, or a piecemeal approach of some VTVM's now, an oscilloscope later, and a signal generator next spring. The answer probably lies in the amount of equipment on hand and how much the Board of Education will provide over a five-year planned budget. Local industries can often be of help if they are aware of the school's need.

In summary we might say the opportunities for developing the individual student's potential through an E/E program are great if: (1) there is a balance between theory and practice; (2) there is a democratic atmosphere with student choice of appropriate activities; (3) there are opportunities for each student to show his own worth; (4) there are supplies and equipment available; and (5) there is a sincere desire on the part of administration to provide an atmosphere in which pupils can grow. There can be no "canned," fixed program of E/E if we are to meet the need of each student.

Junior High School Communications In the Large School

DONALD F. HACKETT, *Professor of Industrial Education, Georgia Southern College, Statesboro, Georgia*

DRAFTING and draftsmen exist because of the need for communication between designers and builders. Drafting is a graphic language that plays a small but important part in a greater effort of civilized man—the effort to communicate.

Drafting does have academic respectability and, when sold as being the language of engineers and industry, meets with little opposition. However, I find this, in and of itself, slim justification for running boys and girls through the typical drafting course. The claim that this experience is "exploratory" should make us view it most critically—and the size of the school has nothing to do with it.

Man's efforts to communicate stretch back over 600,000 years to the early ancestors. During the first several hundred thousand years, primitive man developed and improved stone tools. About 35,000 years ago, human beings like ourselves appeared. They were called "reindeer men." During the next 20,000 years they developed stone tools such as gravers and borers and javelin heads and fish spears of bone. They also developed the first forms of art, drawing and sculpturing.

At first these drawings and carvings, scratched on cave walls with a sharp stone, only said, "This is a bison," or "This is a deer." They were "thing" pictures. When the pictures were made to show two deer fighting, they would recall to those who had seen a reindeer fight, what the artist had in mind. Through his picture-story, the artist was *communicating.*

In time man learned that a symbol, such as a stick figure, could be used to represent the lifelike picture. By adding characteristic features to his symbols, he could add meaning. A man symbol with a spear in his hand meant *hunter.* "Idea-symbols" were probably first made by joining two thing-symbols. The symbol for mouth (a picture of two lips), when added to the symbol for water (a wavy line), gave the idea-symbol *drink.*

Next, the ancients used the sounds of their spoken words to give their picture language greater meaning. A picture of a *bee* and a *leaf* were read *belief.*

Some words and ideas were impossible to draw. Until man learned to use pictures for letters rather than symbols, his capacity for written communication was limited.

About 6000 years ago, the Egyptians first used pictures to represent letters of an alphabet. Their system of writing, known as hieroglyphics, combined thing-pictures, idea-pictures, sound-pictures, and letters, plus an explanatory symbol or two for each word.

The Phoenicians were expert traders, sailors, and manufacturers. They needed a written language for their business records. So, about 3000 years ago, they borrowed and simplified the Egyptian system and produced an alphabet.

The Greeks borrowed 19 characters from the Phoenicians and by the fifth century B.C. had established the shapes of a 24-letter alphabet.

The 23-letter Roman alphabet had its origin in the Greek alphabet of about 700 B.C. They used 13 standard Greek letters and added 10 new ones by remodeling and finishing other Greek letters. The Romans did not need *J, U,* and *W*. *U* and *W* were developed from the letter *V* about 1000 years ago and *J* developed from the letter *I* about 500 years ago to give us our 26-letter alphabet.

Throughout this period of alphabet development, tools and materials determined the shapes of the letters. The Egyptians carved their letters in stone with a chisel and mallet. Later they invented papyrus and the brush and quill pen to write on it. These new writing tools permitted changes in the letter shapes. The shapes of the Phoenician letters were influenced by the wedge and clay tablet they used in writing. The Greeks scribed their letters in wax with a stylus thus accounting for the square shape of most Greek characters. The Romans developed a twin-pointed scriber for laying out letters on stone and developed the beautifully proportioned, graceful letters we use today.

The scribes and monks who laboriously copied manuscripts during the dark ages developed what we call the lower case or small letters and from these, cursive writing.

About 1450 Johannes Gutenberg's movable type made the written word available to one and all and created the printing and publishing industry. To keep up with demands, a paper industry developed and other industries appeared to supply the needs of still other industries.

Electricity was discovered in the early 17th century and 234 years later, Morse used it to communicate by wire over a short distance. About 40 years later, Bell's telephone permitted anyone who could speak, to communicate with someone at the other end of a wire. Twenty years later the wireless telegraph opened a Pandora's box of new communications devices. The time between invention, discovery, and application was reduced to decades. It is measured in weeks today—and behind it all are better communications and the need for still better communications.

Communications, then, is a larger and much more fertile area of study than is drafting for the junior high school. It is my hypothesis that a course of instruction in communications is of more concern and value to junior high school children than drafting, a relatively narrow offering. Consequently, I am suggesting a course in communications as a substitute. This course is intended to develop concepts, attitudes, skills, and knowledge that give junior high school children a more realistic picture of the world today.

Some of the concepts to be developed in this course are: (1) man is a tool-maker and tool-user; (2) man civilized himself through technology; (3)

communications enable man to civilize himself more rapidly; (4) man communicates in many ways; (5) social and economic problems result from changes in communications technology; (6) all industries are interdependent and therefore dependent upon communications.

The course is organized into the following areas:

I. The Graphic Arts: A. The development of our alphabet; B. Printing and duplicating; C. Photography; D. Drafting; E. Painting, drawing, and sculpturing.

II. Wire Communication: A. Telegraph, telephone, teletype; B. Recording equipment (phonograph, tape).

III. Wireless Communication: A. Radio, radar, television, navigation devices; B. Semaphore, blinker, signal flags.

As a result of this course, a junior high school student should receive a good introduction to the culture and technology of communications. Furthermore, he should be able to ***intelligently select*** a technical course in drafting, electronics, and/or printing and photography in senior high school where these courses would, hopefully, present each subject in depth and serve the purposes of terminal education or preparation for vocational schools and technical colleges—including colleges that prepare industrial arts teachers.

The sequence of the courses in the junior high school might be altered, but a pupil should be able to enroll in three ***different*** courses in the three-year period.

A laboratory for a junior high school course in communications would be one of three laboratories provided in a large school, the others being power and manufacturing. The power laboratory would provide for an overview of the cultural and technological aspects of all forms of power development, transmission, and application. The manufacturing laboratory would do the same for the manufacture of products of wood, metal, plastics, textiles, ceramics, and the like.

Advanced Drafting in a Small High School

WILLIAM B. LANDON, *Drafting Instructor and Department Head, Englewood High School, Englewood, Colorado*

THE *Industrial Arts Guide* for Colorado schools lists the following seven objectives for mechanical drafting: (1) provide exploratory contacts with as many different types of drafting as possible; (2) provide opportunities for general education, pre-engineering and prevocational training; (3) teach usable skills in the production of working and pictorial drawings, freehand sketching and lettering; (4) develop the ability to read and interpret drawings through mental visualization; (5) develop the ability and the habit of using drawing to plan jobs of a mechanical nature; (6) present a variety of interesting and useful facts about industry; (7) develop a degree of accuracy and neatness in doing a job well.

These objectives were provided as a guide for developing drafting programs in both the junior and senior high schools of Colorado. Perhaps you will want to delete some of them and suggest others.

It was intended that drafting in the junior high schools be a part of the general industrial arts program. The course would be offered for a period of six or nine weeks, and would be exploratory in nature. Simple orthographic projection, pictorial drawing and freehand sketching would be presented. The use of drawing in other industrial arts courses and in everyday life would be stressed.

In developing a beginning course in drafting for senior high school, it was intended that all of the seven objectives be kept in mind. The course should be designed to give the student background and general overview of drafting as a graphic language.

Englewood, Colorado, a suburb of Denver, has a population of approximately 37,000 people. It is chiefly a residential area. There are a number of small industries in the community, and there are, of course, several large industries in the entire metropolitan area.

The senior high school population is roughly 1,550. Of this number, 846 students are currently enrolled in the industrial arts department, many taking more than one course in the area. Drafting has an enrollment of 264; advanced drafting, 102; and 17 are in their third year.

Asked why they have chosen advanced drafting, a few of them state that they have enrolled in the course because it relates to some other interest area in the industrial arts program. The majority are interested as pre-vocational training or as a college preparatory course for engineering or architecture. There are, of course, those who like to draw and need a subject to fill out their schedule. Hence, the course has been developed to meet the individual need, interests, and abilities of the students.

Second-year drafting is divided into two areas, architectural and mechanical, and the students are asked to select either, on the basis of what they have learned and on the basis of their interests, purposes, and abilities.

In the course in architectural drafting, each student designs and plans a residence. Much time and effort goes into the planning. The house is planned for the family. The student considers all requirements of the family; their hobbies, their income, and their special needs. The social, financial, and legal aspects of purchasing property and building a home are studied. Some of this information is brought to the class by resource persons from outside the school and from other departments in the school.

Each student is required to complete an acceptable set of house drawings, a model of his house, and an estimated cost of lots, building materials, heating, wiring, and plumbing. Local contractors and business men have been very cooperative in supplying this information and assistance. The students are encouraged to be practical in designing and planning their houses, but at the same time they are encouraged to be creative, use new materials and new ideas.

At the present time, mechanical drafting covers revolutions, developments and intersections, production illustration with time spent with the study of descriptive geometry.

Students in the third year of drafting also have a choice of several areas in which to study, and are encouraged to broaden their knowledge of general drafting by gaining some experience in as many areas as possible.

Whether a course can be classified as industrial arts or vocational education depends mostly on the student's purpose for taking the course. Most of the boys in third-year drafting are enrolled so that they can broaden their knowledge of drafting and gain pre-vocational training. They know that high school graduation will terminate their formal education. They have an interest, ability, and training that will enable them to enter industry. Perhaps this is good. Advanced drafting in our high school cannot be classified as purely industrial arts in general education. But, it is meeting the needs of many boys who are attending a school that does not have vocational education in its program.

Assignment sheets which cover both specific and general assignments are furnished to each student. Thus, the student is never in doubt as to his responsibilities. An overhead projector is used for instructional purposes along with class and small group demonstrations and films.

All of this points to what we think has been a fairly successful advanced drafting program. How do we evaluate the success of the program? Most of the evaluation is based on the achievement of the graduates in engineering programs and in industry.

Advanced Senior High Drafting In a Large School

WILLIAM J. WILKINSON, *Director, Industrial Arts Department, Nether Providence School District, Wallingford, Pennsylvania*

OUR late President, John F. Kennedy, once said, "There is an old Chinese saying that 'Each generation builds a road for the next.' The road has been well built for us, and I believe it incumbent upon us, in our generation, to build our road for the next generation."

In our drafting rooms we have the opportunity to lead our boys and girls, with drawings and blueprints, toward the roads of tomorrow—more complex than those when we were searching for the right road to travel.

In my advanced drafting classes, I inform my students in the beginning that they are all engineers; and, that I am not the teacher but their consultant engineer. This alone gives each a lift of personal pride in the work they are doing. We all work from texts, but I for one do not stick to the textbook completely. During the course, I take each of the students out of the drawing room to somewhere in the building or on the school grounds and have them sketch a particular piece of equipment which would be necessary to have made over again or repaired. They make their sketch of the particular piece, then come to the drawing room, draw up the piece and make a working print.

The students, after visiting the site of the work, are not allowed to go back to check dimensions, etc., after they have started the drawings. Many times in industry men are sent many miles to do just this thing, and they cannot have additional trips to check what they missed on the first trip.

Another interesting project to develop individuals and to bring out their own ideas and creative ability: A block of white pine, 3 by 4½ in., is given to each member of the class. He then has to develop, design, and work this block of wood into a concrete item, and submit the worked block of wood with a working drawing.

I have never had, from any of my classes, any duplication of the items submitted over a number of years. I have tried to develop in each individual the opportunity to advance according to his potential.

If you have never had a project like this, I feel quite sure you would find much interest developed, not only with the student, but your own interest as a developer of human individuals for the roads to tomorrow.

Fulfilling Individual Potential in the Junior High Wood Shop

GEORGE R. McKAY, *Hillside Junior High School, Salt Lake City, Utah*

SINCE the big push for scientific education, we have come to the realization that education, as a whole, needs some revamping.

In Utah, as most of you know, education has *really* been receiving emphasis. For at least the last sixteen years, education had been relegated to a back seat . . . . Through constant effort on the part of educators, however, the politics in Utah have been greatly altered. Many teachers were unhappy that our association didn't do more than impose national sanctions against Utah. I believe, however, now that we look back on the situation, that the nationwide publicity Utah received during the crisis did more good than we ever thought it would.

Pressure was great enough from the public as well as from the Utah Education Association. The education bills received more attention from the legislature than ever before. Usually education measures have been the last consideration. An all-out effort is now being made to bring Utah education back up where it belongs.

With increased monies being spent for education it is up to us to do all we can to insure that the students we teach come as close as possible to fulfilling their individual potential.

The junior high age group is probably the most unpredictable, unstable, changeable group, physically, mentally and socially, of any age group in school. Because of this fact, individual instruction is not only more important, but also more difficult. This makes it imperative that the teacher know as much as possible about each of his students.

I teach at a junior high with about a thousand students, from average and above-average income families. Our teachers are fortunate in this respect because education is given great importance by our patrons, most are cooperative with the school, and parent conferences are often a valuable source of information concerning our students.

School records concerning test results are a valuable source, also. The office provides each teacher with the rate of learning, scholastic standing, and reading level of each of his students prior to the beginning of class work.

Perhaps the best source of information is the one we use the least, the pupil himself. Many times this information is given unconsciously. An experienced teacher can pick up and interpret many of these clues and threads of information and obtain important parts to the puzzle of each individual.

Once some basic knowledge of the individuals in our group is learned, our next step is to provide the environment that stimulates creativity.

Everyone is born with the desire to find out how, when and why. This desire to learn must be stimulated. The progress a student makes is influenced by our use of authority, organization, planning and selection of materials. This is brought to light in the book *Perceiving, Behaving, Becoming.*[1]

"As long as the teacher plans the work and directs each activity, it is the *teacher* who creates—it is *his* work—and pupils learn only to conform to his direction. It is the real and active involvement in planning which encourages creativity and allows children to experiment with new and different approaches."

I know a teacher who has taught for 45 years and has always used the same core project. In round figures, he has caused the students in his class to saturate the area with about 9000 camp stools. Is this teacher stimulating creativity? Certainly not. He is teaching conformity to direction.

I don't have anything against camp stools or any other project, but I believe there are other more stimulating means of teaching. Students could be involved in the planning and organization of an experiment in industry, in considerable problem-solving and creativity in developing methods of production, design and cost control. Of course, such an experiment is more hectic than simply assigning a core project, but consider the outcome. Students not only learn basic skills, but they are involved in planning, organizing, and producing. Some of the problems that are industry's are theirs.

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[1] Arthur W. Combs (Chairman). *Perceiving, Behaving, Becoming.* Association for Supervision and Curriculum Development; 1962 Yearbook, Washington, D. C. The Association, 1962; pp. 154-55.

By involving students in all activities in the classroom, the student becomes more confident and less dependent upon the teacher.[2]

"Common practice in today's classrooms with regard to teacher influence can be expressed by the rule of 'two-thirds'. Two-thirds of the time spent in a classroom, someone is talking. Two-thirds of the time someone is talking, it is the teacher—for the teacher talks more than all the students combined. Two-thirds of the time that the teacher is talking he is lecturing, giving directions, or criticizing the behavior of students. One-third of the time he is asking questions, reacting to student ideas, or giving praise.

"In a classroom in which there is greater freedom for intellectual curiosity, for expressing ideas, more positive attitudes and more achievement of content, the rule of two-thirds becomes, in effect, the rule of one-half."

Students should be encouraged to express themselves. In many cases we teachers talk too much and the student has no opportunity to express his ideas.

Flexibility is not found in below-average classrooms. Of course, I realize that certain regulations have to be adhered to. There are state requirements which must be followed. In Utah these requirements are not too rigid. In Salt Lake City schools, a student must complete one year of industrial arts activity sometime from the 9th to the 12th grade. However, the course the student takes is not so rigidly prescribed that there cannot be flexibility.

I have tried to accomplish some flexibility by not requiring completion of a core project (9th grade wood). The time that I used to teach just mechanical drawing now is made more meaningful for the student because he uses this time planning his own project, not a pre-planned, assigned project. The student becomes involved in designing, drawing, and figuring the cost of his project. He also determines the procedure in making the project and the tools to be used. By the time the student is ready to build the project, he is completely familiar with the project and has at least formed some concepts of how to complete the project. I'm sure this approach is not new and is quite widely used.

May I add at this point that teacher attitude is extremely important. Very often teachers go into the shop with the attitude that the students and the teachers are opposing forces. If this is the case, teaching becomes a battle right from the beginning. Communication between teacher and student is disrupted when both sides are on the defensive.

"A teacher must trust and respect each individual student as he is, regardless of his behavior. A child finds it extremely difficult to trust himself and others until he knows that someone cares for and trusts him. Until he trusts himself and others, he will participate in few, if any, creative activities. The ultimate aim is a classroom atmosphere in which there is mutual trust and respect between the teacher and each student, as well as between students. Here the student can take the risks required in being creative."[3]

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[2] A. Harry Passow (Editor). *Nurturing Individual Potential.* Association for Supervision and Curriculum Development; 1964; pp. 62-63.

It has been my experience in teaching woodworking in junior high that interest runs *high*, but I have also found interest runs *longer* and workmanship is better when students have been involved in creating individually.

Environment, to me, is not just attitudes or personalities, but is a physical thing. Our physical surroundings either stimulate or depress our desire to create. Mutilated bench tops seem to become more mutilated. Equipment, unkept, becomes even more abused. Industrial arts teachers are more involved in good housekeeping and machinery maintenance than any other teacher in the building. Properly maintained equipment, however, is a *must* to any functioning industrial arts facility.

It would be impossible in this brief paper even to touch on every facet of teaching and learning. Volumes have been written on these subjects. It is my desire to point out a few areas where I think improvement can be made by emphasizing the importance of knowing more about the students you teach. Only then can one hope to understand their personal and immediate needs.

It is important that students be involved to the maximum level and that the attitude we project is a friendly, cooperative one that encourages students to free expression and participation.

In closing, may I ask this question: Are we satisfying individual differences or are we merely making students conform to our directions?

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[3] Arthur W. Combs (Chairman), *Perceiving, Behaving, Becoming.* Association for Supervision and Curriculum Development; 1962 Yearbook, Washington, D. C. The Association, 1962; p. 147

Wood in a Large Junior High School

MYRON E. LEWIS, JR., *Associate Professor of Industrial Arts Education, State University College at Buffalo, New York*

THE setting, whether it be rural or urban, a large or small school, should not dictate the content of a course. However, we are all aware of the fact that wood, or any other industrial arts course, varies considerably with the size of the school.

Size governs horizontal development. Small schools cannot financially justify unit shops. In a large school, where many shops are necessary, the pattern of a series of unit shops has developed. Junior high school boys rotate through these shops, spending an average of nine weeks in each one. The comprehensive or general shop situation is practically nonexistent today in urban schools. This is particularly true in New York, my home state.

Recent graduate students expressed views both in favor of and opposed to this nine-week organization. These teachers favor the fact that they can concentrate their efforts in one area, they do not have to share a shop with other instructors, and they do not have to stock supplies for many areas. The interest level of the students is greater in wood than in many other areas, thus lessening the problem of discipline. In opposing this unit trend, teachers have complained of the limited amount of time they have with the students. If the nine-week figure is used and the average class meets 40 minutes a day, five days a week, we must agree that a well-defined, highly concentrated course must be taught.

In an urban situation, the identity of the instructor, no matter what the subject area may be, is lost in sheer numbers. Students will have to be offered more in this setting than a cut-and-dried course in hand-tool woodworking. And at the junior high school level, the success or failure of senior high industrial arts programs is determined.

I accept the fact that it is being done but strongly reject the idea of teaching woodworking as general education at any level. We say we teach about an industry but in reality we teach about a very small part of a very large industry, that small part being the rudiments of cabinet-making on a very elementary level. The large industry is an all-encompassing one and truly meaningful as a part of general education, the forest products industry. The first problem then is to establish what products are derived from the forests. The second problem is to define the economic, technological, and sociological impact that this industry has on our society.

Today there are over 5000 products produced from the tree forests and over 2600 chemicals derived directly from the tree. The percentage of this resource that is used in various broad areas of production is not always stable and may be misleading, depending upon the reasons of the agency doing the compilation. However, tree resources are used in construction, paper, plastics, fabrics, foods, medicines, preservatives, filtrates, distillates, and furniture, to name a few.

The significance of the second problem should be obvious from the titles just listed.

I propose that the name of the course be changed from "wood shop" or "general woodworking" to "*The Forest Products Industry*." Whether you teach in a one-room school, a centralized rural school, or a large urban school, the objectives should be the same. Are you teaching general education? Would you want your children to take your course?

An Advanced Woodworking Class In a Small School

GERALD CHEEK, *Kansas State College, Pittsburg, Kansas*

THE potentialities of man can only become functional and operational when learning takes place. Schools are the main institutions that are given this responsibility. There are no other agencies concerned with the adolescent through which we can accumulate the growing understanding of human development. The school must plan a coherent program for conserving human resources and evoking the human potentialities that are awaiting development. But are we, as educators in the field of industrial arts, really meeting the problems involved? Do we merely stand idle and resist changes, to preserve a program to suit our needs rather than the students'?

Usually students have been orientated in a school program that consists of learning facts, memorizing specific knowledge, and training in skills. What they really are doing is learning so that they can, without further teaching, continue to learn and to cope with new tasks and problems. In order to do this, a favorable condition must be available for the student to continue self-rewarding learning in which he can discover himself. Setting up a learning situation so that spontaneous learning and creativity will take place is the key to developing human potential.

The wood industry is changing, and we must change with it. Our program must offer a flexible, understandable, practical, thought-provoking approach to woodworking. Our program must benefit the individual as well as the group to develop their potential.

One way to study the wood industry, and to give every student an opportunity to place himself, is to set up production and mass-produce an actual product. You may go as far as creating a market for the product and sell it. This will allow for the varied interests and backgrounds of the students. A student may have the opportunity to design, plan, control quality, study flow of products and machine placement. He may also study management, cost-accounting, and advertising in a woodworking class. This sounds like it may be getting off the usual path of just woodworking, but it may spark a student to spontaneous learning.

To develop each individual, a channel must be made for him to flow into, so he will find a place, will do more than is expected, and will create on his own. This does not imply that the basics of woodworking should be left out or forgotten, or that the student be left to choose only what he feels like doing. This will not be a lazy program, but one of energy and hard work toward excellence.

In a small school, the woodworking teacher has a much harder job because he must be aware of the needs of the students that come from different environments, from the farm and from the city. These students will be different in their attitudes toward materials, tools and work, and should be treated as such. Even their project selection will be different. A student may learn just as much by building a tailgate for a truck or a coffee table. Maybe a dining table would look better at the annual display than a cattle feeder or a workbench, but a student should not be limited by you or your program.

If a student wants to be employed as a carpenter or cabinetmaker, there is seldom a vocational department available in a small school to send him to. The teacher must take it upon himself to give the student individual instruction in these areas. Does this mean that the industrial arts class has turned into a vocational class? It really does not matter, does it, just as long as the student accomplishes something.

Several hurdles in a woodworking program may prohibit a student from developing his potential. One may even be our friend, the project. Many feel that the project should be eliminated entirely. Evidently these people feel that the project takes too much time that should be allotted to information and to experimentation. This would probably suit the very intelligent student, but this would be way out of step for the slow or average learner. It is true in many cases that the project is over-emphasized. It should serve only as a vehicle to carry information to the student. Many times the project is even the rating scale of the program. If the student designs and builds a good project, the class for him has been a success. Has it really? Is this ground solid enough to build a program on?

Core projects sometimes develop hardships for the individual. Many may have done similar operations before and finish quickly, while others do not have a connecting point and take much longer. Does this indicate that each is developing to his potential?

It would be a crime to set a program so rigid that it could not be changed to suit the student. It is a challenge to get the best out of your students so they may develop their potentialities. To do this will be a tough job. It will need careful planning, individual instruction, and the imagination of yourself and your students.

Advanced (Senior High) Wood In a Large School

DAVID A. RIGSBY, *Associate Professor of Industrial Arts, Appalachian State Teachers College, Boone, North Carolina*

THE topic has a rather long title, but a somewhat shorter meaning. As I see it, it means to take care of each individual child that the public entrusts to the individual teacher and to treat him as an individual—the real key being the ***individual.***

We, as public school teachers, be it junior high, high school or college, are charged with the education of the children of the public. Now every American child has an inherent birthright to his share of education. He has the right to be treated as an individual.

If we were in Nazi Germany at the time of its rise, or in Communist Russia or China, then the state would pick the children it thought it could get the most from, provide them with the education it wanted them to have, so they could provide progress for the future of the state. This makes the state supreme and the individual exist for the state.

America was founded by individuals for individuals. Its growth, into the most powerful and the richest nation the world has ever known, has been made possible by its individuals making their own progress, seeking their own fortunes, and protecting their country when it was necessary. Therefore, who has the right to say which child should get what education? No person has the right to deny any child his share of education. To take from a child any part of his share of education is just the same as, but on a much larger scale, robbing him of his dollars or of any other personal property.

I have heard so many times from a woodshop teacher or any industrial arts teacher, "I get only the left-overs, the dumbclucks, and knotheads." Don't think I am advocating industrial arts as the dumping ground for the school. I am not. For if every child is given his share of education, there will be no dumping ground. A teacher generally gets from students what he demands. I don't mean what he demands verbally, but what his actions demand. The world is made up of a mixture of people, anyway you classify them—be it racially, socially, economically, by mental ability or physical ability. The children we teach are going to have to live in this mixed world of people. What, then, is the best situation in a school to work with different levels of ability, and where children can learn to work in this mixed world? There is only *one answer*—the school shop.

Two members of the present school staff get closer to students than any other—the coach and the shop teacher. They work with individuals in informal situations. The very nature of their work puts them much closer to individual students. Not every student can be an athletic star, but almost every student can have a successful experience in the school shop, if treated as an individual.

I passed through a high school woodshop the other day that was somewhat old, but was large and extremely well-equipped. It was operated by a teacher who is considered to be an outstanding teacher. About half of the boys or better were studying other subjects, drawing, playing, or just wasting time in one end of the room while the teacher was working with the others. The total of the group was just a normal-size industrial arts class. When asked about this, the teacher referred to the group in the end of the shop as "those dumbclucks with low I.Q.'s that are not worth wasting my time with. They can't learn anyway." Is this taking care of the children of the public? After all, the public pays for the schools to take care of their children and each child is entitled to his fair share of education. Everyone has a psychological need for self-esteem and accomplishment, be he child or adult. Our students feel a drive to succeed and excel. This can be accomplished by being a star athlete, giving the best speech, having the lead in the school play, being the best in any subject-matter class, but there are not enough of these top spots to go around. If an individual in a school shop builds an individual project of his own choosing, for his own needs, and of his own design, guided by the teacher, so that he finishes with a project of good quality and good taste that is desirable to other people, he has then gone a long way toward satisfying his psychological need for self-esteem ad accomplishment. Most experts in the field tell us this satisfaction does a lot toward making a good solid citizen.

Now, can the teacher afford to work with all of the students? *He can't afford not to.* We are told the cost of taking care of imprisoned people, enforcing the law to take care of borderline cases, social workers, and the cost of welfare added to the cost of taxes from nonproductive people, is tremendous. If a teacher saves just one boy from such a life and makes a good, solid, tax-paying citizen out of him, the teacher has earned his salary for life.

The plan of procedure I would like to offer is the project method where the teacher takes each individual student where he is, and does as much for him as he can. I like to think that we teach old-fashioned American patriotism and citizenship via industrial arts.

Let us remember, we are the keepers of this country's most prized possessions—the public's children. We as teachers have not been given the almighty power to decide what lies in a child's future; therefore, we are charged with the responsibility to do as much as we can for each individual child who comes under our influence.

Beginning (Junior High) Power Mechanics In a Small School

VIRGIL L. CARTER, *Instructor, Industrial Arts Education, Augusta Senior High School, Augusta, Kansas*

To point out some reasons a course in power mechanics should be included in the junior high school level of the industrial arts program:

First, let's go back a few years when these students were at the elementary school level. At this age, most every boy likes to build model cars. Some boys, at this age, can even be called experts, because they have learned every part of the car, and its function in relation to the car. I believe that the junior high level is an excellent time to start a program of power mechanics, while their interest is still high and motivation may be easily stimulated.

Second, power mechanics is the fastest-growing occupational group today; therefore, the student participating will be exploring a fundamental occupational area. (I probably see more of this situation than most of you here today, because Augusta, Kansas, where I live, is only 15 miles from downtown Wichita. About 32 percent of the men of Augusta work in the factories in Wichita; another 35 percent work in oil refineries nearby, and the rest own or work at various businesses in Augusta.)

Third, it gives the student a chance to learn about the principal sources of power, when and how these were developed—and for what purpose they are to be used. It gives them a chance to study the history of power, learn the vocabulary of power, and see how power is produced.

Fourth, the teacher has a chance to capture the interest of these students, because of their dealings at this level with small power equipment such as power mowers, outboard motors, motor bikes, and other power units.

Fifth, it gives the student a chance to see for himself the relationship between metalwork and electricity—since all power mechanic units are basically metal with applied electricity.

These have been the reasons for including power mechanics in the junior high industrial arts program. Now I would like to present information concerning the planning of power mechanics in a small school.

A unit of power mechanics can be included with other phases of industrial arts. The combination of a metalwork class and power mechanics, or a combination of electricity and power mechanics, may work in unison with one another. This plan has been adopted in many of our smaller schools today.

Ideas which an instructor should keep in mind when planning his power mechanics program are:

- Know his own situation in the organization of power mechanics at his school.
- Collect all the information possible on materials, equipment, and supplies pertaining to power mechanics.
- Know the exact cost required to add power mechanics to the industrial arts program. If we fail to figure close enough on some of our expanding programs, this puts our administrators in a bad situation.
- Know the amount of per-pupil load enrolled in each class. Be sure to have an understanding with your guidance counselor on this matter.
- Plan the arrangement of equipment efficiently, for the teaching of power mechanics along with another area of industrial arts. Test your plan for workability.
- Work with the administrators and allow them to understand the importance of power mechanics in your particular situation.
- Get at least 3 good textbooks on power mechanics before you decide on the one to use. Publishers will send complimentary copies of their various books if you explain that you are going to select a text for a particular subject. Here are a few of the many good textbooks available: POWER MECHANICS by Pat Atteberry; SMALL GASOLINE ENGINES by George Stephenson; and EXPLORING POWER MECHANICS by Harold Glenn.

- In what is called the "Jet Age", it is very important to obtain films concerning the mechanical function of jet engines. These can be used intermittently as needed, to correspond with certain lessons and to stimulate interest. Use all the visual aids available on this subject, because the interest is tremendous!

- Try to obtain actual models of certain types of motors for classroom instruction. Many companies which build and sell small engines will contribute a motor for instructional purposes in order to advertise their products.

Advanced Power Mechanics in the Small Senior High School

GEORGE R. BROOKER, *Automotive Technology, Kansas State College, Pittsburg, Kansas*

IN the field of power mechanics, we have some of the greater possibilities in the entire school curriculum for challenging and motivating students. Properly organized and taught, our field can lend meaning to and show application for almost every other subject in the curriculum. The scope of power mechanics is so great that it will encompass almost every level of ability. We can show the disgruntled boy in mathematics that one cannot understand even a lawn-mower, without getting into some mathematics; and we have but to study the theory of nuclear reactors to challenge the most advanced abilities.

In the small senior high school the problem of planning an advanced power mechanics course is especially challenging because of this wide variation in student abilities. It requires a course of study flexible enough to be within reason for the poorer student and yet it must be capable of challenging the superior student. Because of the limited time for offering such a course and the limited staff available to teach it in the small high school, we will invariably find this entire range of student abilities thrown together in one class. To handle a group of this type at one time and make it challenging and meaningful to all members calls for a great deal of teaching skill. We cannot justify a different course for each level of ability, but we can and should allow and encourage each student to advance to the maximum level of his ability. This is possible because of the great wealth of theory and related information behind even the simplest power-generating device. We can take a relatively simple engine of the type found on lawn-mowers and scooters and challenge the abilities of our whole class. While some student may not be able to master much more than Lentz's Law of Magnetism, the Otto or Clerk cycle, and the major moving parts, the other end of the ability range can cover thermodynamics, inertia forces, hydrocarbon fuels, and the phizo-electric principle.

Of course, this means some independent research on the part of the more advanced students but most boys, if properly motivated, will be eager to learn more.

There is a common association today between these little gasoline engines and power mechanics. I am not implying that there isn't a place for this type engine in our courses but they should be used as a means to an end, not an end in themselves. They make a good teaching aid because of their low cost, small size, and student interest, but if we stop here we cannot justify calling such courses "Power Mechanics." The content of a true power mechanics course should encompass the whole range of power-generating devices. Naturally the gasoline engine is an important unit but it should be used as a building block for other prime-movers. It is only a short jump from gasoline engines to diesel engines and then on to aircraft engines of both reciprocating and turbo-jet design. Our unit on aircraft engines will be more meaningful if we include some aerodynamics and flight theory. These two units dovetail together as very few subjects do, and what boy hasn't admired the clean, graceful lines of a modern airplane. Student motivation should be no problem in this type of course.

We still have a world of material to cover in a genuine power mechanics course, though. We have the whole family of rocket engines to investigate and study. One can scarcely pick up a newspaper without reading of their feats of speed and distance. By today's standards, Buck Rogers was a pedestrian. The human mind can hardly grasp the progress made in this field during this decade.

The electric motor and power generation should not be neglected in our course because here we can show application for the laws of electricity and magnetism. Today virtually everyone uses electric power in their homes and it does many of the tasks which boys of high school age used to dread. Our problem with electricity is not one of finding information to present to our class but one of keeping it from absorbing more than its fair share of our time. The small, student-made electric motor can do wonders towards encouraging knowledge of motor principles.

Steam power plants should make up an important segment of our course. People are prone to associate steam with the ancient threshing engines such as Case, Reeves, and Nichols and Shepard or the "Iron Horse of the rails," the steam locomotive. There is a good deal of justification for these nostalgic associations because they were the applications of steam power which most people were acquainted with, but the brainchild of Rudolph Diesel has moved into these two fields and forced these puffing, smoking, steamers into obsolescence. Steam today has entered a new era. The steam locomotive is as dead as the Dodo bird, and well it should be, with its smoke and ashes and its roaring six percent thermal efficiency. It has been replaced on the railroads by diesel-electric units, but for stationary power generation, steam is still king. It no longer drives double-acting pistons though with their "monkey motions and spool valves"; in place of these, it slips swiftly and silently between the blades of turbine wheels and stators in modern steam turbines. These quiet, powerful machines are engineering marvels and their thermal efficiency is outstanding.

A visit to a modern electric power generating plant cannot help but leave a lasting impression on a power mechanics class.

This, I believe, is the secret to making the power mechanics course meaningful. We are all familiar with the ancient creed of industrial education, "learning by doing," yet so many of us overlook the fact that we have at our disposal some of the best, most interesting, and expensive teaching aids in the world: modern industry and its products. In the small school we cannot hope to purchase large groups of expensive equipment, but then it really isn't necessary. It shouldn't strain the average school budget excessively to purchase several small gasoline engines. These can be obtained free from some companies or purchased from others for about five dollars each. These will serve as a foundation upon which we can start building our program. For the larger gasoline engines, where could we find more interest than in the students' own car engines? Most boys are more than eager to learn more about their cars, and if properly instructed, they will have considerably more respect for their cars afterwards. Once a boy really understands the torque and horsepower curves of an engine, he begins to see the fallacy of over-speeding or over-revving an engine. It becomes a display of ignorance. We should have no problem finding diesel engine applications around the small high school. To start with, the small high school is usually located in a predominantly agricultural area, and since over half of the farm tractors sold today are diesel-powered, to use an old expression, "the woods are full of them."

Examples of electric power can be found almost everywhere and even the common applications make good instructional tools if used properly. A field trip to a power generating plant can be used to stimulate interest in both electricity and steam.

The space age has made available vast amounts of useful information on both jet and rocket engines. Your congressman can probably provide you with more than enough if you only ask for it. Surplus jet engines are available if you can find enough space to store them.

We have examined here the more important facets of a modern power mechanics course, yet with all the dynamic possibilities that such a course has, with such amazing potential for inspiring students of all intellectual levels as it has, we will find school administrators who will tell you "We tried it and it didn't work." This, I believe, is the fate of the misnamed home mechanics program. Of course we are going to have failures, but they cannot be blamed on lack of material or lack of shop facilities. Show me an instructor with genuine enthusiasm in his subject and an adequate background of training, and I'll wager that he will have a dynamic, inspiring program, regardless of meager facilities. Remember, Christ taught on the hillsides.

In the final analysis the success or failure of almost any program lies in the quality of instruction. If you, as a teacher in the small high school, want to offer a program in power mechanics, and if you are willing to do the necessary study and research to equip yourself to teach a genuine power mechanics course; and if you can acquire the administrative blessings of your school board, then I predict that this will prove to be one of the most worth-while projects in your educational career.

Advanced Power Mechanics In a Large High School

M. D. WILLIAMSON, *Associate Professor of Industrial Arts, North Texas State University, Denton, Texas*

FOR the purpose of this discussion, power mechanics is defined as a study of energy sources and the operating principles of machines that convert energy into useful work.

There are, of course, many and varied approaches that one might take in teaching power mechanics in the senior high school. Curriculum committees sometimes fail to function because of differing opinions as to what power mechanics should encompass. Some would say that it should be interpreted primarily through activities involving the things with which students are closely associated, such as hot rods, motor scooters, and lawn mowers. Others insist that a study of the basic principles upon which these and other power sources operate is the best means of interpreting power mechanics to youth.

Problems seem to stem not so much from differences of opinion as to the definition of power mechanics, but in how to interpret such a course to students in the classroom. If the student is important as an individual, then his needs and his abilities should dictate to a large extent how and what he is to be taught.

In the fifteenth yearbook of the John Dewey Society, entitled *Programs for the Gifted (5, p. 4)**, William H. Whyte, Jr., is quoted as saying that in our huge economic and social organizations today there is considerable evidence that many superior men and women do not achieve their potential abilities because group decisions tend to dominate the individual.

Later in this same book, Michael and Fair *(5, p. 217)*, in their discussion of the high school, warn that a potential danger lies in the typical organization of large high schools to ignore individuality. Bigness sometimes is used as an excuse for ignoring individual needs; but the authors imply that, in reality, bigness makes possible many advantages which permit the recognition of individual differences in students in the instructional program.

The Educational Policies Commission, in its publication, *The Central Purpose of American Education,* states that the central purpose of education is to develop the rational (intellectual) powers of youth. It is further stated that:

"The school must be guided in all things by a recognition of human individuality. Each pupil is unique. He is different in background, in interests, moods and tastes. The uniqueness deeply affects his learning for he can react to the school only in terms of the person he is. No two persons necessarily learn the same things from a common learning experience. The school must not only recognize differences among pupils; it must deal with each pupil as an individual . . . While the development of rational powers is central among several important purposes of the schools provided for all youth, the ability to utilize

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*See references at conclusion of article.

such opportunity varies considerably. The school must meet the needs of those who are handicapped in their rational powers by cultural deprivation, low levels of family aspiration, or severely limited endowment.[1]

". . . These abilities may be developed as well through experiences in aesthetic, humanistic, and practical fields. No body of knowledge of itself will develop the ability to think clearly."[2]

Whether this is accomplished will depend to some degree upon whether methods of teaching are used which help in the transfer of learning from one context to another.

This idea, when applied to courses in power mechanics, has many implications. As an example, for the very low ability group of students, it would seem that an elementary study of internal combustion engines with the development of a basic understanding of principles of their operation might be appropriate. Little more than a survey of other power sources would be profitable to this group.

Others might well study power with a view to developing saleable skills in analyzing and repairing internal combustion engines. This ability group should be able to derive some benefit from a study of power as it relates to pneumatics, solar energy, rockets, jets, fluid mechanics, etc.

The high-ability group should profit from an investigation of power in its larger context. An understanding of the working principles of internal combustion engines, rockets, etc., could be acquired with a minimum of direct contact with the actual machines. Latitude in methodology would permit research and projects by individuals and groups. This would afford a wonderful opportunity for team-teaching with implications for emphasis on economic, social, scientific, and technological aspects of power as it relates to our industrial development and national welfare.

It is said that by the time students reach high school they have achieved approximately eighty per cent of their mental development. How this remaining twenty per cent is developed may drastically affect the contributions of future adults to a society which needs the intellectual powers of every individual. We know that this development is not likely to be achieved to its fullest degree through performing simple routine tasks in which students generally engage as they assemble and disassemble small gasoline engines.

Dr. Robert Oppenheimer has estimated that knowledge doubles every eight and one-half to twelve years. *(1, p. 3)* Change is inevitable. Many facts being taught today may be obsolete before the learner has an opportunity to apply them. The threat of obsolescence then must surely place the teaching of certain facts in a secondary role in education.

Recognizing this, it then should be our primary purpose in education to help each pupil in achieving his potential in whatever way may be appropriate to accomplish the task at hand. It will also be through this approach to teaching-learning that the teacher will achieve his potential.

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Beginning (Junior High) Graphic Arts In a Large School

E. LEE WEIR, *Industrial Arts Department, Northwest Missouri State College, Maryville, Missouri*

IF our students are not developing according to their potential, and I think I am safe in saying that there are many who are not, then what could be a possible plan or procedure which would give every one of them the opportunity to develop according to his potential?

At the outset we should understand precisely the key word "potential." Webster defines potential as "existing in possibility, not in actuality." There is a word which is used in the dark room and is almost synonymous with potential. The word is latent. To pursue this analogy, an exposed piece of film has the potential of being, in the end, a picture as desired. What must one do, however, to secure that final image? *After* the film is exposed, *development* is required to bring out that latent image that results from exposure. The same is true in education. We as educators and teachers must first expose our students, then develop those latent images to make them actualities.

In keeping with the exploratory concept of industrial arts on the junior high level, I believe we should use a two-dimensional approach. First, we must offer the maximum possible breadth to encompass every phase of the field; and second, we must offer facilities for greater depth in learning to our more capable students. The content can and should be challenging to all students. Specifically, we should offer exploration in relief printing, planography, stencil, gravure, photography and bookbinding, to include many types of tools. New ideas must be built upon old ones, and if creativity is to be encouraged, students need the basic tools and skills which make exploration and discovery possible. Gutenberg would not have invented movable type if he had had no background in relief printing. He knew the basics beforehand, so he saw a need for something different. Students need facts to generate new and fresh solutions. The idea is not to teach the same facts to all students, but it is to help them to find the facts that are important to their study; that is, to be able to make full use of the vast storehouses of information available in libraries, museums, laboratories, industries, and in the words, works and minds of others.

Then we must first expose our students to the basic concepts of the graphic arts. To accomplish this we may use numerous methods of exposure. Among these methods are discussions, lectures, demonstrations, films, field trips, authorities from industry, chalk-board illustrations, models, teaching machines, closed-circuit television, books, and many others.

We must, at the same time, keep in mind that exposure and development go hand in hand. We cannot have one without the other or obtain the desired end result without both.

During development we should not treat the students as passive sponges, hoping that they might soak up every bit of knowledge that is presented to them. Again, the same is true of film development. We should agitate the tray to keep fresh developer next to the film. We should also agitate, or change, our methods of introducing concepts and teaching from time to time to keep fresh knowledge next to the student. Graphic illustrations, demonstration, and films in conjunction with lectures are usually better than lectures alone relative to learning stimulation. However, actual personal experiences are necessary to adequate exploration and development of the subject. The techniques we present should open the way to new experiences rather than restrict the thinking and behavior of the students. For example, students need to know the techniques of applying ink to paper, but there is a difference between effectively teaching a basic understanding and working knowledge of techniques, and teaching the students in cook-book fashion exactly what to do. In addition, we must be sure to offer the student ample guidance in his research and experimentation.

Regardless of the route of exploration taken by the student, the teacher should be the coordinator and not the dictator of his planning. Do not tell the student every step—everyone has a mind of his own—let him use his. In teacher-dictated planning, who is creating? If anyone is, it is you, the teacher, not the student. Responsibility for planning can only be learned if the level of responsibility given the student is gradually increased, being sure to allow ample time for adjustment to the new level. Students must feel a need for learning, and they learn what they feel they need. By giving the student increased responsibility we also give him the right to make mistakes. To protect him from mistakes would only serve to prolong his dependence upon others. We must teach the student to see the value of mistakes in that he may learn and advance as a result of having made them. The mistake may be annoying, embarrassing, and sometimes expensive, but do not do for a student what he is capable of doing himself.

To teach effectively in the large junior high school, we must possess adequate and up-to-date equipment, materials, supplies, and space. We should not teach antiquated procedures on antiquated equipment with antiquated materials in an antiquated shop unless we are teaching a history course. As Cronbach has stated, ". . . (It is not) possible to arm the pupil with the technological knowledge that will serve the needs of his lifetime. The typical physical theory, they say, goes out of date in about 20 years." In the graphic arts industries, many of the products and processes in use today were unknown 10 years ago, so our students should be taught current theories and techniques with the newest and most up-to-date materials available so that they may advance from today, not from yesterday.

Advanced Graphic Arts in the Small High School?

RONALD D. TODD, *Instructor of Graphic Communications, Research and Development, Power Technology, and Electronics, Shaw High School, East Cleveland, Ohio*

FOR some reason not readily apparent to this writer, the national convention programs continually deal with problems that emerge from existing courses in industrial arts. I would like to question the continued inclusion of only the areas currently existing in industrial arts, and the apparent differentiation between programs on the basis of school size.

Let me treat these points in reverse order. We must not fall prey to the misconception that the size of a school and the normally-resultant budget should be the guiding factor in determining the educational program. If something is educationally sound, it is good for a class of one or a class of one hundred. Mathematics in a small high school is not mathematics in a large school that has had a major portion of the instructional material deleted. Why, then, must we look at our programs in industrial arts in this manner? Perhaps something is wrong with our approach to that problem.

Let us consider the first question I raised. Why must we accept the existing fragmentation of industrial arts into training units as being correct and permanent? Most of the instructional areas just happened anyhow, and some of the areas just happened to happen more often for no good reason other than convenience. Perhaps there is a better way of approaching this problem.

To set the stage for our topic here, let us look at a high school program in industrial arts that has had all the conventional shop courses deleted from it. At Shaw High School in East Cleveland, where a group of us are involved in change, these courses are currently offered: electronics technology, power technology, research and development, manufacturing technology, construction technology, and graphic communications.

Before we begin this presentation, let us determine what of importance you might get out of it. Behind the activity in which students are involved is a basic structure of concepts—concepts that, if understood, could provide a basis from which we can move educationally.

Well, just what is a concept? Webster says it is an idea of what a thing in general should be. At Shaw we prefer to look at them as simplified summations of unified knowledge.

We must find, understand, and use those concepts to enable us to make teaching and learning easier; and consequently, to enable students to reach their full potential.

Educators such as Brunner, Foshay, Bellack, Davis and others have advanced educational philosophies based in conceptualism. Two educational concepts forwarded by these individuals are: (1) The act of discovering knowledge, that is to say, that students should *discover* knowledge. (2) Students should be directly involved in the study of the disciplines or technologies.

The title of this paper reads, "Advanced Graphic Arts in the Small High School," followed by a question mark. That question mark was not a typographical error. Based on conceptualism, graphic arts cannot stand as a separate educational area. A broader basis must be established into which graphic arts fits. This new area or technology becomes that of graphic communications. This area is not graphic arts with a new name despite what we see under that heading in our national association magazines, and it is not visual education as forwarded by our graphic arts organization. A new name for an old activity does not solve any of our problems.

It would be possible to establish student activities in a new educational area by using at first the two concepts mentioned earlier, the discovery of knowledge and the direct involvement of the student in the study of the disciplines or technologies. We would attempt to get students directly involved in the same work as is being carried on in the technology of graphic communications. We would have the students become so involved in the work of their industrial counterparts that they would in reality become those same industrial workers and would discover knowledge within the activities in which they become involved.

Let us look at two problems approached on a conceptual basis.

1. To communicate graphically. This is not just drawing but communicating through any of many techniques available to the student.

2. The concept of parameters. This indicates that communicative participants must have overlapping circles of experience before communication can take place. An interesting point is how do we provide a student and a machine with overlapping experiences?

Now we must provide another concept before we can continue to set up student activities. This is the concept of structure. This could be the structure of knowledge, a very difficult concept to handle; or it could be, as in our case, the structure of graphic communications. This can provide us, for the time being, with a basic structure on which to build student activities.

Students can take over as engineers, managers, communications technicians, microfilming technicians, functional draftsmen, department heads, reproduction engineers, photographers, industrial designers, mechanical designers, tool and die designers, jig and fixture designers, graphic arts technicians, systems control technicians, and a host of other jobs. These students, working in depth within their domain, have discovered new knowledge for themselves and the other students and, perhaps most often, for the coordinator of the class, the teacher. These students have learned to make decisions using the concepts of efficiency and of the total communicative process.

We must be able to admit that all of this is just in the interim. Just as mechanical drawing became drafting, then technical drawing, and printing became graphic arts, then graphic reproduction, and electricity grew to electronics, graphic communications is changing. With the introduction of such areas as cybernetics and others, a new instructional area of communication and control emerges. We should have a ball with this one.

Graphic Arts in a Large High School

HOWARD E. McVICKER, *Assistant Professor, School Technology, Purdue University, West Lafayette, Indiana*

RECENTLY there have been numerous articles and much talk concerning the upgrading of industrial arts programs to provide more meaningful experiences for the so-called better student. This idea is commendable and has merit, for industrial arts has much to offer any student. Exponents of this emphasis have wielded much influence in this time of scientific glorification.

Don't misunderstand me, wherever physical facilities and staff are adequate, this catering to the better student should be exploited. However, let us not attempt to set up the type of program that has as a primary objective the interests of the upper-level students. For the most part, training for industry encompasses not the college-bound youth but the masses that at best only complete high school. Seven out of ten students enrolling in the ninth grade in 1962 entered the labor force, or into marriage, with a high school diploma or less.

With this type of situation confronting us, I personally feel that *the major* emphasis for industrial arts programs should be primarily oriented for the average and below-average student. Everyone wants to do something special for the above-average and gifted youth.

Before determining lab layout, equipment needs, student load, etc., what is to be done must be considered. What do we want to accomplish with and for the youngsters entrusted to us?

I contend we should expose these young people to as many activities in graphic arts as possible in the time available. The students should be encouraged to participate in *manipulative activities* as often as time permits. How else are they going to determine the intensity of their interest in an activity? Is it our purpose to orient them to industrial activities for potential life occupation? To me this is one of our primary purposes for existence in the public schools. Certainly there are other objectives but the most important is that of showing the youngster what physical activities are going on in the local newspaper, job shop, bindery, sign plants, etc.

The major activities that should be carried on in a large high school graphic arts department, then, should be: layout; letterpress activity, including hand-set type, handling machine-cast type, platen presses and exposure to cylinder presses; offset lithography, including presswork, camera work, layout, paste-up, cold composition, etc.; silk screen activities (all the various methods); photography; bookbinding; linoleum block-printing; and finally rubber stampmaking—probably in that order of importance as well. Other activities may depend heavily on field trips, audiovisual material, and other sources for familiarization.

The physical plant should be of adequate size, say a *minimum* of 1500 square feet and probably closer to 2200 square feet, which would mean a lab of about 35′ x 65′. The lab should be adequately equipped to give instruction in the areas mentioned eariler. Such labs should provide instructional space for 20 to 25 students. A smaller class size, while appealing to the instructor, is becoming increasingly difficult to justify to administrators; larger enrollment becomes a problem in handling as well as in safety.

The general approach that need be followed to accomplish my suggested method of madness would be a period of time devoted to general orientation in the various areas (six weeks at most) with the remainder of the time being devoted heavily to picking up practice in manipulations in the vast number of activities represented in the lab. I do not feel that our *general* education approach should be so general as to require the complete abandonment of development of skills; we cannot and must not attempt to develop skilled workmen. These youngsters, however, need to work with their hands enough in these activities to determine some degree of familiarity with the area. For the most part these students, the masses, are going to be average at best, therefore they will be working with their hands for a living.

What should be our goal, to attempt the highly unlikely and assume that many of these people will be *chiefs* in our society, or should we have emphasis on familiarity of everyday working activities that the majority of our *Indians* are going to encounter in the working world?

In conclusion let me say, in graphic arts the students should be exposed to and expected to familiarize themselves with manipulative activities involved in everyday work, and the related subject matter to enable them to *understand* what they are doing; and to become cognizant of the job opportunities available in the general field. To accomplish this, the schools have the responsibility of maintaining up-to-date facilities and instruction.

Junior High Industrial Crafts In a Small School

ROSS C. HILTON, *Instructor, Brigham Young High School, Provo, Utah*

INDUSTRIAL crafts is the term used to designate all craft activities beginning in the junior high school. These crafts are a significant part of the industrial arts curriculum and of general education. They have, in the past, had more avocational and hobby emphasis than industrial or occupational opportunities. But, need they? Can they, with complete teaching, also reflect industry today? They should.

Basically these crafts have included leather, plastics, lapidary, silversmithing, and in a few instances, ceramics and textiles.

In a small school the greatest problem in the teaching of these crafts is that of time; i.e., the one time your over-all school schedule permits them to take industrial arts, the many areas of industrial arts that must be crowded into this time, and the small or mixed-grade enrollment, all contribute to the time problem. In fitting industrial crafts into the basic industrial arts curriculum for junior high school, these questions arise: How many weeks can be given for instruction in these crafts; which crafts do we select as being the most important to teach in this time; which ones do we exclude; what method do we use in teaching those crafts we select so that they are covered in the best manner for our particular situation and the allotted time block? Answers to these questions solve our problem.

There have been some five methods generally used in the teaching of industrial arts. Briefly they are:

1. The skills approached only with emphasis on skills and work habits, many student-selected projects, little or no course of study, and little if any formal instruction.

2. Skills and related technical knowledge. This approach has both student- and teacher-selected projects covering certain basic skills. The class is more vocational in nature and has good demonstrations that are skill oriented.

3. Art and creativity approach. Here the student spends considerable time in planning and designing a project. There might be found no regular order in class but with the student learning each skill as he needs it.

4. Industry and technology. A formalized classroom atmosphere, related work around problems created by industry, and with skills taught for an understanding of basic processes, are exemplified in this approach. Also included could be reports, discussions, homework, field trips and library assignments.

5. Research and experimentation. This approach involves the student with a problem instead of a project. The skills are taught as needed, much individualized instruction, and a written report as an outcome of the student's work are all peculiar to this method of instruction.

Of these five ways of teaching, which one is the best? No one of them is. We must include a bit of all of them if we are to reach every student we have.

For too many years we have tried to fit every boy or girl into the program (the square peg in a round hole), instead of providing flexibility in the program to give some measure of fit to the learner.

How can this be done? First, we should consider new ways of presenting our curriculum materials so that more can be given, in a better manner, in a shorter time.

Consider the following as possibilities for your teaching:

Teach not only the basic skills and information necessary for that craft, but include the implications of industry, its present and future applications to our society, possible vocational opportunities as well as for leisure time. Include ideas and methods from all five methods of teaching. In each class there are students who are equipped to use one method to a greater advantage than another one.

In a small school an industrial crafts teacher must utilize all his opportunities to be able to teach the most material, the one time he is able to have the student in class. Therefore, he must use special reports, discussions, homework, field trips, library assignments, experimental assignments, many demonstrations, and all the available audio-visual materials.

Any aids such as flexible scheduling, programming of course materials, individualized research, team teaching, and like innovations, must be explored and if found to be helpful and applicable, must be incorporated into our teaching. The learner entrusted to us is to be taught all that is possible about that particular craft in the time scheduled.

Give the junior high students activity of interest, with tools and materials to work with, along with proper guidance and instruction, and they will rise to the challenge to such an extent that our objectives of industrial arts will be realized.

Beginning Industrial Crafts In a Large School

W. A. MAYFIELD, *Bryan High School, Bryan, Texas*

THERE are many factors which influence the organization and purpose of our educational programs. Educational purposes should be based on the needs for effective living in our American democracy. The particular responsibility of the schools in meeting the needs of the individual and of society seems to lie in the twelve areas of living and learning indicated below. These areas must not be thought of as separate compartments. Each shades imperceptibly into the others; together they form a pattern of the whole of living and learning:

Citizenship, character and human relations, basic skills, health and safety, understanding of environment, vocational competence, consumer effectiveness, successful family life, use of leisure time, appreciation of beauty, effective thinking, world understanding.

Our discussion concerning beginning industrial crafts will be general, as it applies to a large school system where it is taught as an elective course.

At this level, the program is based on problem-sharing and exploration by the individual developing his abilities and seeking his interests. Beginning industrial crafts courses emphasize the application of design principles in the process of changing the nature and value of craft materials. Opportunities for individual creative expression are unlimited and may fulfill an avocational need as well as serve as guidance for vocational areas.

This level of crafts makes a very effective semester course. Several areas of instruction such as ceramic, leathercraft, etching, art metals, plastics (liquid and sheet), model building, woodcraft, weaving and jewelry may be taught. Basic goals of the teacher are to develop good student attitudes toward safety, design, cooperation, individual planning and a desire to achieve as high a level of craftsmanship as individual abilities will allow.

Beginning industrial crafts may be taught on a general laboratory basis where two or more activities are operating simultaneously. This method requires much more organization by the teacher, though less capital outlay of equipment. In a system large enough to justify setting up a laboratory for each area of instruction, the rotation of students through the various areas may reach more students and possibly permit a more specialized teacher in each classroom. However, the multiple-activity classroom is more commonly used.

Due to the short interest span of this level of students, several of these basic areas should be included with no less than four in a semester's work; when taught the full year, at least six areas should be covered. More intensive craft courses should be organized and taught as advanced industrial crafts. Another purpose for including several basic areas is that the longer a student stays in one area, the more likely he is to have a problem with the cost of his material, that is, if he is doing progressively more difficult work in that area.

If the school system has a strong elementary industrial arts program, the level of instruction for beginning industrial crafts will be much higher. Usually faculty interest and support will be greater in such a system.

No course is any better than its teacher. A strong in-service training program will contribute toward upgrading any program.

Course Content

A. Ceramics (Introduction, Design, Preparation of clay, Throwing of clay, Coiling method, Slab work in ceramics, Molding, Glazing of ceramics, Firing of ceramics).

B. Plastics (Safety practices and general instructions, Introductory information, Heat treating of plastics, Methods of fastening plastics, Finishing of plastics).

C. Art metal (Metal tooling, Metal enameling, Metal etching, Metal engraving, Metal spinning).

D. Leathercraft (Introduction, Leather tooling, Fastening devices for leather, Leather finishing).

E. Miscellaneous crafts (optional, or may replace one of the areas above) (Textiles, Weaving, Woodcraft, Bookbinding, Model making, Jewelry).

Advanced Industrial Crafts In a Small School

GERALD L. STEELE, *Supervisor of Student Teachers, Department of Industrial Education, University of Minnesota, Minneapolis, Minnesota*

"INDUSTRIAL crafts" is a term which seems to have recent origin in titling industrial arts activities. The term "crafts" has been used for years to describe home-like activities which could be done with little or no training and/or equipment. Of course the term "crafts" has been used to describe the fore-runners of our modern industries, but the practice of the craft trades was primarily done in one-man shops and the home.

The dictionary describes a craft as "an art or skill; a manual art; a trade," and a craftsman as "one who practices some trade or manual occupation; an artisan."

If one is to assume this definition as correct and to accept the following definition from "Industrial Arts Education,"[1]

> The Industrial Arts area of crafts (industrial) may include experiences in the sub areas of plastics, enameling, ceramics, metal, lapidary, jewelry, leather, carving, models, glass, fiber glass and textiles. One of the sub areas, such as ceramics, plastics or textiles, may become a course title and be given major emphasis,

then I feel that the term industrial crafts should not be used. These two definitions are in conflict with each other and present a conflict for those who advocate strict interpretation of industry in industrial arts. True industry today has few, if any, crafts. Most skills have become highly technical and automated. There are very few, if any, small, one-man, home-craft type industries left.

Industry today is not primarily an art, a skill, or a trade. It is a highly organized collection of skills, processes and materials which, by mass production, manufacture products that can be described as highly uniform in size and quality. Mass production is the key to the manufacture of goods which can be competitively priced.

The uniform product was not a major objective of the craft trades of old. Rather, an individually made product with real craftsmanship was of importance.

The term industrial crafts seems to have been placed in our program as a catch-all for those areas which do not fall into the much-taught areas of wood, metal, drafting, etc. It seems to be a place for activities which formerly were taught as a part of another course but which have been forced out through specialization. Art metal and jewelry fit this description. New areas which have not grown in prominence in industrial arts have been put into this division, too. Plastics is such an area.

I assume that if it is an important industrial area which is to be taught, it should have a course title of its own and be treated either as a complete course or as a well-developed unit in a course.

There are few courses of "industrial crafts" taught in our high schools today. Courses such as plastics, ceramics and textiles are, however, being offered and taught in many of the well-organized industrial arts departments.

Those areas such as leather, enameling, lapidary, jewelry, carving, models, glass, etc., might well be taught as a part of the art curriculum, especially if only a few hours are to be devoted to them. There is so much that can be taught which is a part of the modern industrial technology that we hardly have room for such crafts, which could be taught elsewhere. If we assume them to be of enough importance to be a part of the industrial arts curriculum, we should either teach them as a separate course or as a unit within a course, such as art metal within general metals, etc.

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[1] American Council of Industrial Supervisors, *Industrial Arts Education* (Washington, D. C.: American Council of Industrial Supervisors, A.I.A.A.).

Let me illustrate what can be done with two areas which many list under industrial crafts. I think these could provide adequate content for a full or half-year course.

Take ceramics, for instance. This course has been traditionally taught as stab pot, coil pot and potter's wheel work. Yet the ceramics industry today uses little of this, except for developmental work. This industry uses such methods as slip casting, press molds and jigging, etc., for making pottery. Abrasive stones, grinding wheels and high temperature pyro-ceramics are some of the important products of this industry today. Why not teach these methods as a part of industrial arts ceramics courses and leave the pot-making to the art department?

The plastics industry provides another example. Plastics has been taught by using hand-shaping and carving of acrylic plastic projects. Yet the industry does not make products in this manner. The industry uses methods such as injection, compression, extrusion, thermoforming, thermofusion, dispersion, and reinforced molding. They also use laminating, decorating and coating methods to produce their products. These are the processes which should be taught in industrial arts plastics courses.

Textiles provides another similar example. Textiles implies, to most instructors, that the student must learn to use a loom. He then learns advanced loom work and then advanced-advanced loom work. It seems there is more to the textile industry than this. A long hard look ought to be taken at this course, with serious revision in mind.

The traditional areas of industrial arts could well stand a critical revision of the content and methods employed. A few of the sacred cows in all our areas might well be eliminated.

In short, why not discard the crafts idea and teach modern industrial processes? And while doing this, why not do a good job on that which is to be taught.

Advanced Crafts in a Large High School

ARMAND G. HOFER, *Associate Professor, Wood Technics Department, Stout State University, Menomonie, Wisconsin*

IN considering a plan of procedure for a large school, we should first look at how the crafts offerings in a large school would be likely to differ from the offerings in a small school. The large school would probably have better shop facilities, more areas represented in the crafts offerings, better teacher support in the form of teaching aids and craft materials, and perhaps better prepared teachers. On the other hand, larger schools would be likely to have a larger number of students in each class.

In setting up a plan of procedure that will permit each student to advance according to his potential, we should start with a strong philosophy and clear objectives. Before the best plan of action can be worked out, we need to know exactly what we wish to accomplish. We should find a realistic philosophy and objectives that will help us establish an acceptable plan of instruction.

If we accept a "baby-sitting" role, we will attempt to keep the class busy and under control. It is possible for students to learn in this sort of an environment, but most of what they learn will be incidental, and might be described as learning that occurs in spite of the teacher rather than because of the teacher. If we move up to a higher level of instruction we might place great emphasis on craftsmanship. Students would be assigned projects, and well-prepared and presented demonstrations would be given, followed by close supervision so that each student would end up with a project that represented good craftsmanship, and the students, parents, and teacher would probably all be happy with this accomplishment. With the craftsmanship approach to teaching crafts, a student would be much more likely to have learned something of value than through the previous approach simply because he was taught something with emphasis, but this single emphasis on craftsmanship has its weaknesses. The student might have learned something about the materials he used, he might have learned something about design, and he might have developed enough interest that he would attempt to find out what was being done on a commercial basis in some of the crafts areas, but all of this would have been incidental—more or less of an accident. We are much more likely to accomplish something worthwhile if we teach it "on purpose"—decide exactly what we should do and then do it in an organized and enthusiastic manner.

A plan should specify not only the general areas of instruction to be included in the crafts program, but also the emphasis that should be placed on each area. Entirely different results can be obtained from the same combination of craft areas by varying the emphasis or slant of the instruction. Class work might consist primarily of making projects; all instruction and class work might revolve around the art or design aspect of crafts; or everything might be taught in relation to what is being done commercially, with practically no mention of the design aspect.

It seems to me that a certain balance is needed among the craft areas and in the emphasis on the various aspects of each craft area such as design, commercial operations, and craftsmanship, and that the emphasis might vary from one student to another. Obviously students vary in background, interest and ability. Therefore, a plan that will allow each student to develop as much as his potential will allow will need some flexibility. All students do not need the same emphasis on design, for example. The level of accomplishment in design will depend on the ability of the student to learn design, and on the relative value between design and other areas of instruction in the course. A balanced program for each student should include a broad range of experiences in the different craft areas, and some experience with all aspects of the craft including craftsmanship, design, and knowledge of commercial operations. The best combination for most students should probably be a broad range of experiences, but with a chance at a depth of experience in one area.

In addition to specifying what should be taught, a plan of procedure should include realistic means of accomplishing the over-all goals or objectives—an approach that will realistically allow for individual differences.

The different abilities and interests within a group of students require a variation in instruction if it is to be most effective; and the wider the range of instruction needed, the more difficult the problem of instruction becomes. It should be possible in a large school to divide students into sections by potential or interest. The advantage of this procedure would be to reduce the range of instruction required and thereby make more effective instruction possible. However, many administrators object to sectioning classes because this makes the scheduling of classes more difficult.

One of the most promising developments that will allow flexibility in a crafts program (in order to allow more individual development) is programed instruction. It has been well established that properly prepared programed instruction in book form will produce results as good as a well-prepared lecture, and it appears that for many manipulative operations that a type of programed instruction will produce results as good as a carefully prepared and presented demonstration. If students learn just as well from printed materials as from lectures and demonstrations, we certainly should be able to allow students to proceed in different directions as their interests and experience dictate, and each student should be able to proceed at his own pace.

Besides allowing individual work in an area of interest, some means should be provided for allowing individual differences in the experiences comprising the common core of the course. Theoretically each student would learn the most by creating an original design, working out a complete plan of procedure and bill of materials, carrying the project through to completion, and following this up with a review or evaluation of what he has done. At the same time he would study material related to the area in which he is working. In actual practice this theory does not work out too well because not all students are capable of the same level of achievement. All students may be capable of producing original designs, for example, but it would take so long for the poorer students to reach an acceptable level of design that it is questionable whether this is the best way for them to spend their time. A better plan of procedure for students of low ability might be to learn just to recognize good design and then spend more time on a broader range of areas and on the skills and study of industrial processes.

The Supervisor's Role in Developing the Human Potential in Industrial Arts

Facilitating Discovery and Development Of Potential in the Teachers Themselves

ESTELL H. CURRY, *Assistant Director of Industrial Education, Detroit Public Schools*

SAUL W. Gellerman, in his book *Motivation and Productivity,* reports several studies which were conducted to assist management to discover ways and means of motivating employees to greater production. I would like to begin this presentation by stating a few of these findings that also pertain to teachers.

Motivators

1. Teachers can be motivated to do better work if they are given an opportunity to help in the management of their own affairs.

2. Teachers must be welded into a team with common interest if there is to be an effective program.

3. Supervisors must realize that to do a job properly, they must have the voluntary aid of their teachers, and be willing to surrender enough to make that aid attractive.

4. Employees, in time, because of many little annoyances, become depressed, confused, etc. They must be given an opportunity to let off steam.

5. We must also realize, however, that employee-centered supervision or any other forms of enlightened leadership will not stimulate *all* workers under *all* circumstances.

6. Employees' needs are continuously pyramiding. When the one at the top is satisfied, a new one takes its place. Increases in salary, sick leave, hospital insurance, and retirement plans do not work as motivators. Personal growth is the best.

Keeping these findings in mind, what can supervisors and administrators do to develop the potential of each teacher?

Ways and Means of Discovering and Developing Potential

Provide for new teachers to get off to a good start through orientation meetings, which may be held the week before school starts, Saturdays, or after school. In five such meetings in Detroit, such topics were covered as industrial education in Detroit; review of available manuals; developing instructional plans; requisitioning, purchasing, and distribution of supplies and equipment; safety education; guidance and counseling; evaluation; professional organizations; and special activities. Visits were made to the Schools Center Building, the warehouse, a radio-TV station, and the Detroit teachers' credit union.

Orientation meetings also assist teachers on the department head eligibility list to become acquainted with their new jobs. Such topics as these may be discussed: Helping teachers evaluate their programs and in planning instruction; giving leadership to home economics, to family life education, to business education; allocating funds for supplies and equipment; over-the-counter purchases; inventory, maintaining equipment, responsibility for safety education; working with administrators; new trends in vocational education.

Subject area meetings are held in the Detroit schools for each subject twice a year, planned and conducted by the teachers and supervisors, and six to eight department head meetings are held each year.

Teachers need guides and other instructional materials to aid them in their teaching. The best manuals are developed and written by teachers and we recommend Saturday or summer workshops for this purpose, to produce manuals in experimental form and in final editions, as well as safety tests and graphic arts project sheets.

Teachers like to grow and to stay up-to-date, by individual study or by attending college classes; or this can be accomplished by bringing the school to the teachers, with a workshop on improving competency. A workshop for metal teachers may include metal spinning, liquid plastic, enameling, sheet metal. A workshop for elementary teachers and department heads may include laminations, silk screen, ceramic tile, fabrics, bulletin board and show case display, design.

Teachers discover and develop their potentials faster when guide lines are provided . . . . They should be given an opportunity to participate professionally in their industrial education associations, in conferences, conventions, and exhibits . . . . And, teachers can evaluate their own work if provided with check lists and evaluation forms.

Guidance—Where Are We and Where Are We Going in Industrial Arts?

The Role of the Industrial Arts Teacher As a Good Counselor and Advisor to Students

LOUIS J. BAZZETTA, *Coordinator, Industrial Education, Tucson Public Schools, Tucson, Arizona*

GUIDANCE and counseling is today an important phase of the total educational program. Obviously, as such, the realm of guidance and counseling cannot be delegated only to the professional guidance and personnel worker, but is the responsibility of all concerned with education. This, of course, includes the industrial arts teachers. The role that each must assume depends upon many variables found in individual school systems. In numerous small schools the principal, with the aid of the teachers, usually carries on this function. In some fairly large ones, this is often done by an assistant principal, dean of boys, and dean of girls. In some others, trained counselors with teachers assigned in a team approach in a homeroom program are responsible. In others, one might find a director, counselors, specialists in testing and reading, case workers, psychologists, nurses, and others. There is no best organizational pattern that fits all situations. The best plan grows out of the personality and preparation of the staff members, the needs of the students, the community, and the financial support. However, regardless of the organizational pattern, the role of the teacher is of prime importance.

Before presenting the role of the industrial arts teacher in the guidance and counseling program it is essential to present some basic concepts. Among them are:

- That guidance activities include all experiences which a pupil has under the direction of the school which assist him in realizing his potential for becoming a well-adjusted, healthy, useful, and productive citizen.
- That guidance is related to every aspect of the school: the curriculum, methods of instruction, supervision, scheduling, health and physical fitness, extra-curricular activities, and home and community activities. These areas are all interdependent and inherent in the guidance program.
- That counseling, an integral part of guidance, usually requires working with students individually and often will require the attention of specialists in the field of guidance and counseling .... One must also realize that in some respects

a counselor meeting with individual students three or more times during the year may not be as effective as a teacher meeting with the students daily. The undertaking must be cooperative.

- That teachers must realize their capabilities and limitations in dealing with some specialized problems that demand the attention of the professional counselor or specialist. The professional counselor, in turn, must also know and understand the capabilities of the teachers.
- That identification of problems is not enough; prevention is equally important. Unless changes are made that will result in the desired behavioral changes, nothing has been accomplished. These changes may be required in the curriculum, methods of instruction, or personality.
- That in order for a guidance and counseling program to succeed, there must be good communication and rapport among administrators, counselors and guidance workers, teachers, students, parents, and the community.

Having presented some basic concepts needed to understand the guidance and counseling program, let us now focus our attention on the role of the industrial arts teacher.

The industrial arts teacher finds himself in an advantageous and enviable position. First, the informal activity usually found in the industrial arts shops is conducive to the establishing of good rapport with students. Second, industrial arts in the lower grades, in junior high school, and beginning classes in high school are exploratory. As a result, these courses aid in the discovery of student potential, development of new interests and discovery of shortcomings. A student in an exploratory class may learn through practical experience in the shop classes whether he has an interest and ability in the area of industrial arts that is often not indicated in a paper-and-pencil test. Equally important is the negative side, where a student discovers that he really does not have the ability or interest to continue in that particular area of indusrial arts. Test results matched with the evaluation by a competent industrial arts teacher are of great value in occupational and educational guidance. Third, students tend to learn best those things that they enjoy, and most students enjoy industrial arts. In most high schools industrial arts is an elective, and we hope that students enroll in this area because they have an initial interest in this field, or at least dislike it less than they do other courses. Fourth, industrial arts can be of value to all—the slow, the average, and the superior student. Yes, the college-bound as well as the non-college-bound student. Instruction is usually individualized. Finally, the industrial arts teacher by his training and experience in the trades should be qualified to do an outstanding job in presenting the occupational information so necessary in the occupational and educational aspect of the guidance and counseling program.

Let us now consider when the industrial arts teacher actually begins his role in guidance and counseling. It must have its start with the orientation and arousing of interest in potential students in industrial arts. They must be informed of the curriculum offerings in industrial arts in the particular school or high school that they might attend. Some techniques that could be used are: Talks to parent-teacher groups by students or teachers; conferences with parents, students and counselors to explain program; printed leaflets on curriculum offerings in industrial arts; exhibits and displays; radio, television and assembly programs; open house or back-to-school night where parents and students tour shops; tour of shops by prospective students and counselors; and bulletin boards or show-case display in schools.

Next, let us spotlight our attention on what the teacher can do in the role of a guidance worker or counselor to students in his classes. His greatest contribution will be made as part of the regular classroom activities. Sometimes, schools provide a short conference period at the end of the school day in which students requiring special help may consult with their teachers. However, it is in the classroom that the teacher discovers the way a student is developing and notices special problems he might have. Whenever a teacher modifies his method and the content of teaching and works with each student as an individual, it is guidance but also good teaching. They cannot be divorced.

In order to work with each student individually it is necessary for the teacher to obtain all the information possible about his students. This is a big order, especially in the beginning classes where the students are entirely unknown to the teacher. The quickest and best way to do this is to utilize the cumulative records usually found in the counselor's office and available to the teacher. This record will include the student's background, home situation, health, test scores, courses he has taken, activities, accomplishments, future plans, handicaps, and problems, if any. It is the responsibility of the teacher to use this information wisely and to make contributions in keeping the record up-to-date. Over a period of years, observations and reports from a large number of teachers would prove extremely helpful to the teachers and the counselors. Often teachers must make appraisal of some of their students. This might include such items as seriousness of purpose, industry, concern for others, cooperation, emotional stability, social acceptability, scholarship, citizenship, and other personality traits. All this helps the teacher understand and know his students better.

After the industrial arts teacher knows his students better, he is then able to make his teaching more personal, giving individual help and taking a genuine interest in the progress of each child. What adjustments or techniques may the industrial arts teacher use to make instruction more personalized? Some techniques are:

- His class procedure is organized so that each pupil is given a responsibility in the shop's administration, and at appropriate times these assignments are changed. This develops a team spirit and each student learns to carry responsibility.

- He organizes his teaching units carefully. His demonstrations are well planned; he knows what the students are expected to learn, and presents each point in his lesson so it can be understood by even the slowest learner. He realizes that demonstrations, regardless of how well they are presented, are the group approach, but learning does not become a reality until the students actually participate in this activity. First-hand experience makes a deeper impression than vicarious experiences.

- He helps students become familiar with the industrial world in which we live—with its materials, processes, tools, and principles of manufacturing and distribution, that help him discover his occupational and educational possibilities. Field trips to industries could also be utilized.
- He develops skills, attitudes, and appreciations needed to enter gainfully into an occupation or enroll in specialized industrial classes. The industrial arts teacher could also assist in securing employment for his students.
- He can sponsor an industrial arts student club which would provide opportunities for developing student leadership and would be an excellent adjunct to the work in the classroom.

Good guidance and counseling goes on in the industrial arts shop and classroom in which there is a competent teacher—a teacher with insight and understanding of personal growth and development, genuine interest in teaching, and possessing good teaching skills. A competent teacher will always be considered a guidance worker and an integral part of the guidance and counseling team. One must, however, realize that in no way does he replace the professional counselor. His role as a counselor is limited, but will vary according to his competencies and the availability of specialists in the field of guidance and counseling.

What Teaching Methods Are Appropriate to Industrial Arts Instruction and How Do They Apply to Students of Diverse Capacities?

HERBERT SIEGEL, *Director, Industrial Arts Department, New York City*

IT has often been said that, "like snowflakes, no two persons are alike." This fact of individual differences is of tremendous importance to us as teachers of industrial arts, if we are going to develop human potential through industrial arts education.

To the beginning teacher, the actuality of individual differences will become apparent after he meets his first shop group. Individual differences are not limited only to intellectual ability but extend to all other human traits.

For the sake of this report we have characterized the students as gifted, average, slow, and students with a language barrier.

The Gifted Student

The industrial arts department has prepared the following proposal, to be used in the summer school industrial arts program, for grades 7-8-9. This experimental approach to the teaching of industrial arts is based on the assumption that many of the students will be above average ability and therefore will be capable of individual research, and will be qualified to follow a program designed for the gifted pupil.

Project Concept: (1) Be original; must meet the specific needs of the pupil. (2) Include scientific principles, or prove scientific hypotheses. (3) Be creative in design in such areas as ceramics, graphic arts, etc. (4) In the graphic arts area, as an example, all typesetting must be from pupil-prepared copy; creative writing is to be encouraged.

Project Planning: (1) Pupils must prepare their own working drawings. (2) Pupils must develop their own designs and ideas. (3) Pupils must prepare a bill of materials for all projects. (4) Compute cost of project.

Evaluation of Project: (1) Consideration of function and design. (2) Testing of project: *a.* appropriateness of materials; *b.* testing stress of materials; *c.* operation of the projects in the area of electricity, metal or any project with working parts; *d.* proof of scientific principle.

Project Folder: Pupils will prepare a summary report of their projects to include: reasons for undertaking project, sources of materials used, reasons for selection of finishes, personal evaluation.

It is anticipated that a minimum of time will be devoted to normal shop management routines. Shop safety and basic tool operations will be taught as the need arises and as the student progresses with his work.

Printed job sheets will not be used in this type of problem-solving project, all plans must originate with the pupil. However, an adequate reference library will be available in each shop. Students will be encouraged to borrow books for home use, and all reasearch will be done at home. All shop time will be devoted to the actual construction of the project.

The Average Student

The courses of study, *Industrial Arts for Grades 7-8-9*, and *Industrial Arts for Grades 10-11-12*, are very specific in the scope of activities and project ideas which will meet the abilities of the average student.

If any one emerging trend can be pointed to in our city, it is the realization by some of our superintendents that industrial arts is far more than a manipulative activity. Greater emphasis is being placed today on the interrelation of industrial arts with other academic subjects.

As a result of this new emphasis, many schools have shown a greater correlation between industrial arts and science, math, art, guidance, reading and social studies. These are healthy trends indicating that industrial arts education is being accepted as a participating member in the family of general education subjects.

The Slow Student

The problem of teaching the slow student is often aggravated in the industrial arts shop, because invariably it is accompanied by a disciplinary problem. Once the student has been sufficiently motivated, and has indicated a desire to "get on with his work," the teaching process varies considerably with that which is used for the gifted and average students.

Over the years a number of techniques have developed by teachers of industrial arts to help this type of student. Probably the most effective is the Process and Project Board. Templates, jigs and patterns also serve a definite need with the slow student. They help the student to achieve a degree of success and satisfaction in his work.

The very nature of the student indicates that all of the teaching techniques and devices must be altered to meet the comprehension level of these students. Demonstration lessons for the average student might of necessity become two or three lessons for the slow student. Individual instruction and individual demonstrations play a more vital role in shop instruction. Printed material will need to be rewritten to meet the grade level of the child.

The teaching of slow students is a challenge to the teacher of industrial arts. In each child there is some human potential for learning, although sometimes it might be very slight. However, it might be through the medium of industrial arts that the slow student can find himself and thereby become a more effective human being. Through industrial arts, the slow student may see a practical application of his academic studies and frequently this stimulated interest could change the mind of a potential drop-out.

Students with a Language Barrier

A class consisting of students with a language barrier could very well include the full range of the I.Q. scale. Because language is the major barrier to the students' understanding, complete reliance must be placed on the use of sight in the teaching process. Everything must be demonstrated and the student must feed back the demonstration. Frequently the use of the "buddy system" or the services of an interpreter works well. However, it would be far more effective here if the shop teacher acquired a working knowledge of the Spanish language.

Much has been done in the preparation of safety rules, tool identification sheets and elementary project sheets in both English and Spanish. In many schools a vocabulary list of tools and shop terminology is prepared for the core or official teacher to be used in the academic teaching program. Frequently, it is only a short period of time before many of these pupils find their way into the mainstream of school life.

What Ideas, Concepts, Theories and Skills Can Be Utilized So That a Student as an Individual Will Receive Assistance in Shaping His Own Talents, Interests and Aptitudes

ROSS J. McARTHUR, *Chairman and Professor of Industrial Education, Brigham Young University, Provo, Utah*

IN approaching this topic it has been necessary to bring my current reading up to date. Also, considerable time has been spent in analyzing my own teaching, both on the secondary and university levels. Thus the value of my participation in this convention and in this session particularly has already been set in motion and will be realized by my students and colleagues to the extent that I influence them because of this. The value which accrues to you becomes secondary since we have such a short time to interact and we all know that by the late hour of the last day of a convention, our cup is nearly full and in some cases has overflowed.

New ideas, concepts, and theories are presented to us each year, which in most cases we do very little about. We fail to act or react to these for much the same reason which exists when our own students fail to change their behavior as a result of our teaching. Results will only come about when the material presented becomes meaningful in the lives of students. As an example: During the past month Dr. Swanson came to our state and presented a topic concerning the study of American Industry, which is receiving rather wide recognition since it sets forth a new approach in an attempt to meet one of our major objectives. This concept of industry seems necessary in a space age since it gets away from categorization of industry as metal, wood, etc., when it is usually a combination. This concept has a sound basis but most of our laboratories are not so organized nor have the classroom teachers been so instructed. The key to the problem seems to be with the teacher-training institutions since teachers follow rather closely the material covered in their

institutions since teachers follow rather closely the material covered in their

training program, in line with what facilities they have to work with. The secondary students will conceive of this approach to the extent that their teachers present it to them in keeping with their own experiences with industry. Thus we see that any idea, concept, or theories which an individual may have of a problem will shape his talents or interests only to the extent that he sees an application of it in his own life.

In the instructional process we normally deal with groups but we must continually keep in mind that learning can only take place on an individual basis. Each student who comes or is sent to us has specific aptitudes, interests and talents. It is the responsibility of the teacher to recognize these and help each student toward an acceptable goal in line with his potential. To do this the teacher must know each student as an individual. He must be able to recognize the difference between the student who has an inferiority complex and the one who is actually inferior. On the surface both have similar problems but the approach to use with each is different. This would indicate that each teacher must have in his teaching plan the flexibility to meet the needs of each student and realize that all cannot be forced through the same die, yet all can achieve some measure of success if the right approach can be found at the right time.

This reminds me of my first teaching assignment in a high school. It was a school of moderate proportions, requiring a third industrial arts teacher. The two other teachers had been with the school for several years and knew the older students from past years, hence had ideas as to whom they would accept back into their classes. Being new and also having no control of registration, I took all that came. One class was all senior boys who dared me to teach them electricity and welding. The principal informed me the first day that I should be aware of the fact that I had all of the foul balls of the senior class in this one period. Needless to say I did become concerned and realized that it would take all the ideas, concepts and theories which I could muster, along with what teaching skills I could bring to bear, to achieve any measure of success.

For the first eighteen weeks I tried hard to interest them in the wonders of the world of electricity which I had found so interesting and useful while in the Navy. They liked my sea stories which I told to put over certain points, but in most cases I felt there was very little accomplishment. One idea I did get across to some who were more difficult to handle was that a stretch in the Navy or Marines would do them good. On their first leave they usually stopped in to visit with me and let me know how they had reacted. In most cases they had been somewhat humbled by the strict military discipline which had been the basis for my recommendations. Several wrote to let me know that they appreciated my help although they realized that their actions while in school were not always indicative of this.

By the end of the first semester I had lost nearly half my class, which at that time seemed quite an accomplishment but now points out to me that I was not always keeping my sights on the proper educational goals. As I took the rest of the class through welding, I had the opportunity to watch individual

students grow. One especially stands out in my mind, since he had intended to

students grow. One especially stands out in my mind, since he had intended to drop school when I called him in to indicate that his absence was so excessive that he could not afford even one more and still obtain credit as stipulated in the school policy. He then told me that he had little chance of making the grade in physics due to not applying himself. The teacher had informed him that a respectable score was necessary on the test being given the next day in order for him to maintain any hope of graduation. The interesting aspect was that the test was on electricity and he hadn't applied himself in my class either. I told him that if he were really sincere about school, I would go over the material with him to prepare for his physics test. We spent seven hours during that night covering the material and it did the job. From that time on he was a real student in all his classes and he graduated. Both he and his parents thanked me for my effort in his behalf, although my real reward came later as I helped him get employment as a welder where he worked to the top and eventually went to a college where he completed his degree in welding engineering.

I have had other similar experiences, as I am sure that you have. In each case I have tried to evaluate the teaching or learning process that made for the success. In many cases it has not been as dramatic as the case cited although, in all, there seemed to be recognition on the part of the student of his own talents, interests, and aptitudes; and on my own part, the recognition of the student as an individual presenting teaching moments which didn't always mesh with the time I found most convenient to teach that which the student wanted to know. It made me realize that a time for turning on and off the teaching and learning process, as many teachers seem to view it, is most unrealistic, and cause of many of our problems. The greater the extent to which we as teachers realize that our professional responsibilities span the entire day and, in fact, our entire lives, the greater the influence we will have on shaping the lives of individual students.

The project method of instruction has been used for nearly a century with varying degrees of success and is now under fire due to the nature and rate of change in industry. It would appear to me that we need to look about us and see what others are doing with this method. Take the science people, for instance. They put on science fairs each year with a great following and the central theme is the project. As I observe many of these projects, I cringe at the workmanship—yet many of the students also take industrial arts, and a good quantity of the scientific principles involved are industry-centered. The question arises in my mind as to why most of the work was not done in an industrial arts laboratory. What I am trying to get across is the idea that in many cases, we as teachers use the project as a means of keeping Johnny busy with his hands and forget all about many of the other parts of his anatomy and character which need to be considered in the learning process. I have observed that few of our top students, when competing with their well-made projects, understand the technical information which has made most of the products they use possible. The interest is there—with a little encouragement, the student would dig into it much as he has done with manipulative activities.

The Individual Potential from Technological Developments With Implications for Industrial Content . . .

As Viewed by Industrial Education

WILLIAM P. SPENCE, *Chairman, Department of Industrial Education and Art, Kansas State College, Pittsburg*

I believe change is in order today just as it will be 25 years from now. We can never cease to strive for improvement, up-dating, and new concepts. My comments, however, are not radical. Today I am talking about what we could do right away to utilize better the individual potential of youth without sweeping changes. With our existing philosophy, laboratories, and teachers we could be doing a better job. My suggestions, therefore, are not the ultimate but should be understood to be something we should strive to do to develop industrial arts education as the revolution, that is sure to come, gathers force and direction.

Since the industrial arts program is a part of the basic education of American boys and girls, we assume that all youth would be exposed to a study of the tools, materials, processes, products, and occupations of industry. If this assumption is correct the students will vary in individual potential, from those with little potential to those who can succeed at anything they try. We would find students in our classes who can achieve some degree of understanding and success in manipulative experiences but be total failures in the simple academic skills such as English, mathematics, or elementary science. Industrial arts can and should offer meaningful experiences for these youths.

The vast majority of youth would fall into the "average" classification. Most of our students seem to fall into this group. Our major emphasis should be

The vast majority of youth would fall into the "average" classification. Most of our students seem to fall into this group. Our major emphasis should be

directed to this level. These youths exhibit a wide range of potential. The industrial arts program should be such that it pushes or forces them to work to the maximum of their ability. Such a program could begin to approach the development of skilled performance and technical understanding commonly associated with the skilled trades. Industrial arts should offer courses with content of sufficient complexity to work the best of youth to the limits of their potential. So often even average youth are bored with the diet offered under the guise of general education.

What should be the scope of industrial arts? I believe it should include content that would be of sufficient caliber to be equal to that offered by our technical institutes. We have long stated that we would like to work with superior youth, yet we usually have little to offer them. We tend to give them the same diet that we give everyone else. I advocate including in the scope of industrial arts areas such as descriptive geometry, electronics, photomechanical processes, process instrumentation, and metallurgy. I realize the average student would not be very successful in these experiences but they should still be a part of the scope of the program.

I am advocating, therefore, that industrial arts in our public schools make available an extensive range of offerings to meet the needs of the students and to challenge them to the limits of their potential.

In addition, the range of technical complexity should include a broad spectrum of technical experiences. The offerings should include all the major industrial areas. For example, the graphic arts industry is fifth in the nation in dollar volume and payroll yet practically ignored in the industrial arts program. It involves more than setting type and printing from it. How about the vast paper industry and ink manufacture? It includes advanced photographic processes.

The scope of industrial arts should include the various facets of a commonly-accepted definition: a study of the tools, materials, processes, products and occupations of industry. This sounds very fine but is in practice not realized. Seldom does it include a study of industrial processes; we tend to ignore the materials of industry; a study of occupations is usually completely omitted. If we could broaden the scope of our courses to fulfill this very old definition, the place and character of industrial arts today would be quite different.

Perhaps content for courses for the less able should be more along the lines of that offered by the comprehensive general shop. These youth cannot get involved successfully with the more difficult manipulative skills or technical knowledge. I am suggesting that they be exposed to a wide range of experiences involving many materials and simple skills, to occupations in which they could have a chance to succeed. For example, a study of mass production industries could be undertaken and the jobs of less than the tradesmen level could be explored. What kind of jobs exist in these plants for the less able? Why not study other jobs such as service station attendants, electrical helpers, plumbers' helpers, and heavy equipment operators? It is of little use to study jobs beyond their potential, such as electronic technicians or engineers. While many youth tend to over-estimate their potential, it does not relieve us in industrial arts education from exposing them to more realistic job choices.

The average youth should receive experiences in good general unit shops. I am not going to advocate sweeping changes in content. What is needed immediately is to equip the shops with up-to-date equipment and employ competent teachers. If we only tried to live up to our definition of industrial arts, I believe we would be better meeting the needs of this group with existing typical course content. Possibly the biggest failure in content with this group is the neglect of related information and a failure to relate to American industry.

The major change in content I could recommend is to up-date the courses by including current techniques for fabrication and to use and study new materials of industry. We are still making our students glue up stock for table tops rather than using plywood. Then we make them hand plane the top and scrape it with a hand scraper. Drafting traditionally involves solving a series of mutilated blocks rather than practical problems. Students of this type could benefit from a study of material procurement and the subsequent mass production of goods.

The content of our efforts for the above-average youth involves the area in most serious need of re-evaluation. This could include not only contemporary industrial processes and materials but a study of the structure of industry. Product development, production planning, product manufacture and distribution, and the profit and loss facets should be a part of the course content. While these students need to develop certain skills and understandings, they should be encouraged to become involved in research and developmental work. This may mean that they do not build a take-home project but some device of an experimental nature. Obviously this is difficult to do if the student is forced to proceed through a long series of "basic" manipulative experiences.

I am suggesting that these sacred "basic" experiences could be skipped or postponed. If a student needs to weld to complete a device he is developing, I suggest he be taught how to do this. So often he is told he cannot weld it because it is not in the course of study or else he has to learn to draw, file, and rivet before he welds, because that is the way the course was written by the teacher. Since when is the magic list of units developed by the teacher to be the optimum? It more likely is the minimum. As a high school student, I was in industrial arts classes in which the students were years ahead of the teacher. Two of my contemporaries were in an electrical unit with me. We had to make a buzzer and a toy motor from a nail and some tin cans. This was in the course of study. After school these two students operated a ham radio station. Their cars were rolling electronics labs. What I am trying to say is that it is better to set this superior youth to work on challenging technical work even though it is not in the course of study. Let him soar under the guidance of the teacher. Get the science teacher to help. Call in a local radio-television service man for help, but do not hold back these students.

A superior student can quickly master the operation of a metal lathe. Challenge him by trying to set up an automatic manufacturing process on this lathe. It could involve hydraulic, pneumatic, or electronic controls. It would involve machine work, welding, threading, computations, and a host of other experiences. Is it so important for these youth to master all the skills of the machinist, or is it more important to get him to thinking, planning, designing and developing?

How May Industrial Arts Content Be Constantly Up-Dated?

The first and immediate problem is to improve the industrial arts teacher education programs. Currently most programs prepare a teacher who is very shallow in his technical preparation and who is out of date before he graduates. Do your teachers-in-training get anything more than general metals, welding, and machine shop? Do they use a machinability computer, study basic metallurgy, or process instrumentation? Do they get anything more than hand-typesetting and hand-fed letterpress work or do they get photomechanical processes, offset presswork, and paper and ink testing?

In-service education on a vast scale is needed. The best way to do this is through an extensive summer school program. Here the newest developments can be taught. This can be undergraduate or graduate credit. How many colleges and universities offer graduate-level technical classes? I do not mean a rehash of undergraduate courses but real, high-level graduate experiences. Workshops during the winter months are helpful but usually too short. They do stimulate the inquiring teacher to study on his own.

Our professional journals need to publish the latest technical developments. Teachers should subscribe to the technical journals in their teaching area. These are in great abundance. Industry offers technical papers free. (U. S. Steel Corporation's "Technical Papers" are an excellent example.)

School boards usually require teachers to return to school after a period of years before additional salary promotions are available. This requirement could be a tremendous stimulant to up-dating. Unfortunately most school boards require that this be graduate work and much of it is taken in the departments of education. Courses in extra-curricular activities, secondary school supervision, or school administration do little to up-date an industrial arts teacher but they do get him that much sought-after master's degree.

City directors of industrial arts can arrange weekly meetings or summer workshops for up-dating their teachers. (Dr. Walter Brown of Phoenix, Arizona, does this for his staff. He brings in consultants for a week or two to work with his staff during the summer.)

Up-dating can be done and must be done.

Relating Human Potential to Expanding Technology Through Industrial Arts

DENVER SAMS, *Head, Department of Technical and Applied Arts, School of Technology, Purdue University, Lafayette, Indiana*

No other generation of people in the history of the world has witnessed the kind of technological advances we have seen in our lifetime. At no stage in our history have we gone backward. We have taken every new step forward as only potential for further progress. That progress has been achieved by a people dedicated to the principles of freedom, a people dissatisfied with any state of achievement, a people willing to sacrifice, to fight, and to die for the perpetuation of the potential inherent in their freedom.

Let's look first at the nature of potential . . . .

Atomic energy is potential beyond the average imagination. It remains only potential until it is triggered by other energy. The energy required to propel a bullet from a cartridge is only potential until it is set off by a firing mechanism. The fuel injected into the cylinder of an automobile is potential energy, but it never becomes that unless ignited by the spark from the spark plug.

An uneducated, hungry, and poverty-ridden populace is potential force of a varying nature. We have seen the subjugation of many such groups by communist forces in recent years. Yet we have seen other such groups respond to the forces of freedom. The potential in each case becomes a reality only if acted upon by some other force. It is important to remember that all forms of potential can be controlled, can be given direction toward some desired end.

I will now look briefly at the nature of technology . . . .

The dictionary gives two separate definitions of the term "technology." One calls it the science of the application of knowledge to practical purposes; the other calls it the totality of the means employed by a people to provide itself with the objects of material culture.

Let's look at some examples of technology. When the Wright brothers demonstrated their lighter-than-air craft at Kittyhawk, little did they realize the kinds of technological progress that were to be built upon this base they had established.

Charles F. Kettering invented the automobile starter. Since the battery can have its energy replaced by the generator, look at all the technological advances that have been built into the automobile since Kettering's invention. These include such things as the radio, the heater, air conditioning, headlights, and many others.

Perhaps James Watt was one of our very first known inventors. He was the first person to convert heat energy to mechanical energy. This was the first real discovery of a substitute for human labor. It was this invention that led eventually to the disappearance of slavery, for slavery then became unprofitable as a means of work achievement.

Watt's steam engine was used by Edison to generate electricity, thus extending the influence of the original development because unlike the energy of the steam engine, the electrical energy could be distributed great distances on electrical wires. Watt's engine triggered the Industrial Revolution in England which also instantly migrated to America. In subsequent order we have seen such technological developments as interchangeability, mass production, rapid transportation, rapid communication, mechanization, and automation. The single invention of the steam engine released all of this potential.

The development of the wheel could probably be associated with every facet of our technological progress, yet it remains only potential to many backward nations today.

To these examples of technology can be added numerous others of our times, such as jet propulsion, solar energy, color television, atomic power, miniaturization, and the computer. The definition of technology given earlier surely fits these examples, for they have helped to bring us many material realizations.

All facets of our educational system contribute toward these realizations. But we are interested here in the unique contributions of industrial arts in relation to human potential and technology.

Industrial Arts and the Technician-Technology Explosion

One of the greatest ways to kick the lid off potential is to exhibit a clear need for the application of that potential. It is probably true that many of our high school dropouts could be salvaged if they could identify themselves with a clear-cut challenge of personal service and involvement that relates to the kind of training being given to them.

Fulfilling a need is perhaps the best manifestation of human potential and personal realization. Exploding technology presents an abundance of needs. It is estimated that between 100,000 and 200,000 new technicians are needed annually in this country. Unless these aids are provided for engineers and scientists, the full creative potential of these latter groups cannot be realized. As the spectrum of technical knowledge widens, this need for technicians will increase. An annual increase of 3 per cent is predicted for the graduates from technical institutes during the next ten years, but the annual need for these graduates will increase five times as fast. Thus for every three new technicians we graduate, fifteen will be needed.

A rather natural phenomenon in our society is impeding our efforts to meet this increasing need. Most high schools still gear their programs toward college preparatory efforts. This makes some sense in the light of the potential concept being discussed here. The theory is that the greater the amount of education, the fuller the utilization of the human potential. The real truth of the matter is, however, that our society still attaches an unwarranted stigma on any form of education that terminates below the college degree. This stigma has perpetuated an unrealistic emphasis by parents and counselors on the glamor of the college prep programs in high schools.

Our continuing practice of guiding more young people toward college in absolute defiance of the increasing need for more training of less than college grade is simply a case of spreading the frosting too thick and the cake too thin. This practice is illustrated by a recent survey in a prominent midwestern state. Whereas 81 per cent of all the high school students in this state are enrolled in college prep programs, only 7 per cent of the people employed in this state are working in positions that require a college degree. Furthermore, 42 per cent of the employed are in technician categories.

We know that a large percentage of those who enter college will not graduate. I personally believe that a greater psychological jolt results from failing in college than from entering a more realistic level of training in the first place. The problem, of course, is to bring about a greater general belief in the possible realization of individual potential in work categories that do not require a college education.

How can industrial arts education in schools contribute to the solution of this problem? I believe we should start by doing a better job of making youngsters aware of the technological wonders of now and of the opportunities growing out of them. I think we engage too much in activities that reflect technology of the too-distant past, and perhaps some of us lean too heavily on the glamor of the fantastic predictions of the future. Along this line it is interesting to note that President Roosevelt's advisors on technology of 27 years ago missed in their predictions such things as radar, rocketry, nuclear energy, antibiotics, and the electronic computer.

I think industrial arts can throughout the school years help to develop an appreciation and respect for the absolute necessity for the performance of work in all categories at all levels and thus begin to break the barriers to the entry into training for some work categories that do not require a college degree.

The critical business of aiding youngsters to identify their interests and abilities at an early age is a role industrial arts can play. Because of the technical nature of industrial arts, those interests and competencies that relate to the life and work of industrial technicians might especially be discovered in such programs.

I believe industrial arts can bring many high school students into close contact with the life realities of some of their other studies. If our programs are conducted properly, they can actually sample for the student some of the involvements of a technician, thus vividly illustrating the real meaning of such subjects as chemistry, the communicative skill subjects, and math.

All of our senses are constantly in touch with results of technology. Every day we see, feel, hear, and taste better things that result from the effective application of our increasing knowledge. Couldn't industrial arts create a desire to participate in this application of knowledge?

The technician must engage in activities that involve problem solving. Certainly the industrial arts program can provide such basic experiences, and many of our good programs currently do this.

Materials, tools, machinery, and processes are the very essence of a technician's life. There is enough to be learned here so that it can be spread out to include the foundations of such knowledge acquired through industrial arts programs at all levels.

Skills are a basic requirement of the technician. The engineer no longer deals with these skills. Elementary skills of a great variety can be acquired in industrial arts. They can be intensified at the technician training level wherever the need for more intensified skill exists.

The interaction of personnel in industries suggests a broad base of technical understanding for the technician. This broad base may be started in industrial arts by basing our instruction on process clusters rather than on isolated operations. For example, I think the engineering technician should have a knowledge of basic machining actions, but this should not be limited to metals. I think the engineering technician should possess knowledge that would enable him to associate any shape in any material with that family of processes that might be used to achieve that shape. A plastic soap bottle, for example, might be made by the process of blow forming, but how would a similar shape be created in glass? Such knowledge would enable an industrial technician to deal with alternatives and increase his potential for contributions as part of a manufacturing team. Education releases this potential. Industrial arts education can help to develop this kind of knowledge.

Interdisciplinary communicative ability is a critical asset of the valuable technician. Industrial arts can begin the development of a basic vocabulary and basic understanding of a wide variety of technical fields.

The ability to work effectively with others is perhaps the first requisite of a successful technician. The team approach or group method employed in industrial arts can make a budding young technician aware of this essential quality and provide sound practice towards its development.

If industrial arts is to play an important role in the development of potential that relates to the growing need for technicians, industrial arts teachers must acquire a greater understanding of the total work of the industrial technician.

The industrial arts program may make its best contribution to technology by providing the atmosphere in which many youngsters can for the first time experience real success. This self-realization can unlock potential that may perhaps lie impervious to other educational efforts. Industrial arts must deal more with the history and the present of our technological advances in order to help youngsters realize that new ideas, new concepts, are really just potential. They must be made to realize that the vast potential of new ideas can be unlocked or triggered only by the constant search for and application of new scientific information relating to these new ideas.

Expanding technology has created vast new horizons of opportunity for the utilization of human potential. Our educational system faces a consequent expanding responsibility for the preparation of our youth for these opportunities.

We should point with pride to the unique contributions of industrial arts education to this effort.

Symposium—Needs of Youth Are Not Met by a Single, Uniform Program of Instruction

Maximum Development of High Capacities

J. B. MORGAN, *Assistant Professor of Industrial Arts, Southern Colorado State College, Pueblo, Colorado*

WHO is this high-capacitied person? What curriculum changes are necessary, what teaching methods are best suited to meet his needs? Who is best qualified to teach him?

High capacities are not absolute; they are relative. All too often the capacities of individuals are defined in terms of performance on an intelligence test. Of the 61 dimensions of the mind discovered to date, verbal comprehension, memory, numerical facilities, reasoning, perception, and spatial orientation have frequently been included in intelligence tests. It has been interesting to note in recent literature the extension of concepts of high capacities. A few of the dimensions in which a person may have a high capacity but which are not usually measured by today's intelligence tests are: sensing of problems, originality, flexibility that is spontaneous and adaptive, fluency of association, penetration, visualization, artistic ability, athletic ability, sociality, and morality. These concepts suggest that we, as educators, might be wise to identify the top 10 or 15 per cent of the students who have high capacities in these areas and then provide educational programs designed to develop their talents.

A Curriculum to Meet the Challenge

After the students with high capacities have been identified, they should be placed in a situation that will provide the best opportunity for them to develop their capacities to the fullest. The best placement may be in regular classes, in segregated classes, in special schools, or in accelerated programs.

If we are to meet the needs of students with high capacities in our classes we must keep our objectives well in mind, possess a well-grounded philosophy, and provide a flexible curriculum which will meet this challenge—flexible enough to broaden and to give depth as necessary. The curriculum can be broadened by integrating more and more with other subject-matter areas such as art, math, science, social studies, English, etc. We can add depth to our program by including more class discussions; by using problem-solving techniques in projects; by allowing independent research and experimentation; and by letting students plan and use mass production methods. The curriculum can be strengthened by allowing these high capacitied students to make judgments, formulate ideas, and draw conclusions.

Instructional methods and techniques which are especially effective emphasize: (1) student leadership in carrying on class activities; (2) individual and group oral activities; (3) student participation in planning learning activities; (4) freedom for students to select individual projects; (5) a minimum of repetition and drill work; (6) freedom from unnecessary administrative restrictions; and (7) student leadership and responsibility in organizing the class and in discharging classroom routine. A learning situation with these characteristics, under the supervision of an intelligent, resourceful, and stimulating teacher, should prove challenging to students with high capacities.

Teachers for the High Capacities

The success of any program for students with high capacities depends on the qualifications of the teacher. The well-qualified teacher for students with high capacities may be described as follows: well informed in many areas, knowledgeable in his subject matter area, modest but confident, interested in the creativity of students. He is sympathetic and patient, free from jealousy, possesses good mental and physical health; has positive personality traits, is a good salesman, open-minded, willing to make decisions, ingenious and resourceful, stimulated by criticism; he has a high degree of understanding of the learning process and is experienced in counseling and teaching.

Summary

If we are to stimulate students to be creative in our society, to be producers of goods in the future, and to be people who can think for themselves, I suggest that we exhaust all of our energies in implementing some of these curriculum changes into our programs. In many cases these suggestions will not be new since they already are being used and have been found to be effective. The heart of the problem of developing talent in students is the selection and organization of learning experiences that will pace the learner at an optimum rate of advance in areas of learning in which he has high capacities. We are missing the boat if we are unable to stimulate our students so that the best in each student is demonstrated in his particular way.

Work Study Programs

DON KINNAMAN, *Chairman, Department of Industrial Arts, Alhambra High School, Phoenix, Arizona*

WORK study programs are currently the subject of much interest on the part of educators and other individuals working with youth, probably because of new legislation, specifically the Economic Opportunity Act. This act, as we shall point out, expands the horizons and possibilities of work study programs by providing funds for interested and energetic individuals and groups (including school districts), who have long wished to further explore and implement this educational area, to be able to do so.

The fact that work experience is important in the process of growing up has not escaped the attention of educators. For a long time, occupational education has contained work experience as an integral part in many courses. What has been called "cooperative education," which combines a job with study, has been practiced in some engineering schools and technical institutes, as well as in some high schools, for more than thirty years. In 1928 there were seventy-eight cities with 5682 pupils enrolled in cooperative courses under the Smith-Hughes Act. The government-aided diversified occupations work-study program was started in 1933. Since World War II there has been a substantial growth of work experience programs in schools.

The following types of work experience are now found in secondary schools:

1. In-school, non-remunerative general education work experience programs.

   Experience is provided in the school for students as typists, clerks, parking lot attendants, messengers, multigraph operators, library assistants, motion picture machine operators, locker maintenance workers. Students are not paid except for after-school work. In some cases, credit is given toward graduation.

2. Out-of-school, non-remunerative general education work experience programs.
   a. Community service work in noncommercial organizations: libraries, parks, social agencies, elementary schools.

b. Student-learner assignments in physicians' or dentists' offices, architects' studios, hospitals, city or county offices.

3. Remunerative general education work experience programs at the junior high school level.

This is for youth who are likely to drop out of school at age 16. It is usually provided for 15-year-olds. School credit and "going wages" are given. Typical jobs are as bus boys, messengers, waitresses, car washers, printers' helpers, sales clerks.

4. Remunerative general education work experience for pupils in senior high school.

This type of program is for youth in senior high school who will profit personally and economically from work experience in such a way as to make their schooling more attractive and more successful. Scholastic credit is generally given for work which is coordinated with school studies.

5. Remunerative occupational work experience in senior high schools not subsidized by federal funds.

A "diversified occupations" type of course is offered, mainly to high school juniors and seniors over 16 years of age who have good records. Often the course is set up in schools or communities too small to qualify for the federal subsidy. Some of these students will get work experience in selling jobs, some in office assignments, and some in factories. An effort is made to place the student in the field where he is likely to work as an adult.

6. Remunerative work experience programs in high schools subsidized from the federal vocational educational funds.

Commencing in 1917 with the Smith-Hughes Act (which was amplified in 1946 by the George-Barden Act), a cooperative part-time education and employment program is available to high school juniors and seniors. Jobs are in the trades, industrial occupations, and distributive occupations. This is the most highly selective program; it is seldom available to a student who has done poor work in school.

The Economic Opportunity Act offers opportunities for work-study programs under Title I through the Job Corps, which by its structure includes a continuation of a youth's education and occupational training in resident centers or camps throughout the nation. The act states that where practical, such programs may be provided through local public educational agencies or by private vocational-educational institutions or technical institutes. The act also provides for programs of useful work experience for enrollees.

Part B of Title I provides for work training programs for unemployed young men and women, ages 16-21, through participation in state and community work training programs.

Part C is entirely devoted to work-study programs for college students, and it is left up to the ingenuity of the institutions of higher education to create whatever imaginative work programs they may feel capable of success.

Part A of Title II offers under the General Community Action program an opportunity for educators and business men through the instrument of the local community to structure, among other things, work-study programs that can provide marvelous opportunities for students through which they can obtain skillful training, experience, and receive compensation for same.

The opportunities are present; however, it is necessary in order to implement these opportunities that school boards, administrators and teachers take the initiative, create their programs, obtain the cooperation and coordination of local industry and work with the officially designated Community Action Program. It may be argued that many of these programs might only be such as to provide work disciplines. We do not consider this to be a negative factor, but rather a positive one. It will depend to a great extent upon the enthusiasm of industrial arts personnel to help create programs that significantly can contribute not only to the teaching of good work disciplines but also to good work skills that will qualify the individual for prime consideration in the labor market, and point him down the road of vocational success.

Enrichment and Acceleration: Two Heads on a Chestless Man?

ROBERT L. RANDLEMAN, *Assistant Professor and Head, Arts Department, University High School, University of Minnesota, Minneapolis, Minnesota*

WORDS used in an unfamiliar context have an amazing capacity for jolting one's emotions and/or on occasion stimulating one to reason. The terms enrichment and acceleration applied to industrial arts assume just such a role. Industrial arts has tended to hold about itself an aura of fundamentalness—a touch of the good earth if you please—unencumbered by academic sophistry. An obvious reason for our reasonably well maintained state of grace is that the industrial arts have never been forced to act as an intermediate rung in the ladder of educational aristocracy. Colleges have not sought our favors and vocational schools have taken youth on assessed value without undue recriminations against earlier institutions attended by the students.

When one faces the question, "Should industrial arts pursue programs of advanced placement or enrichment?" a number of assumptions appear to have been made. One is that our existent programs satisfactorily provide a definitive core beyond which we may "accelerate" or around which we may "enrich."

A second assumption is that criteria used are true to the cause.

A third assumption seems to be that given sufficient time in our "Proposal Era,"* we will clear up the annoying discrepancies between criteria and the curriculum core, and that appropriate methods will be developed apace. In brief, the inscription reads—given time we will fit the punishment to the crime.

Subject matter areas in the secondary schools have demonstrated the unfortunate assumption that they are able to field an autonomous army and wage an independent campaign. Although this assumption may seem peripheral to the problem at hand, it is in fact a necessary conclusion to the preceding three points. If the secondary-school curriculum should appear to the student as a seemingly Godforsaken maze we should not be surprised. Rather than participate in a nice clean war, he is compelled to bear arms in a half-dozen simultaneous Koreas.

To return to the question—acceleration and/or enrichment—we may very easily answer the question once the validity of the preceding assumptions has been accepted. For the youth who has vocation direction and who has "mastered" the core, a program of acceleration toward vocational competence is an obvious solution. Students given to less foresight but equal mastery deserve our very best enriched, high vitamin product. If, on the other hand, we give audience to the disquieting possibility that our criteria might be faulty, the question itself becomes an absurdity.

The position shortly to be professed assumes the question to be just such an absurdity. Curriculum has tended strongly to reflect an optimum intellectual condition on one hand, and on the other, an optimum other-directed behavior. The curriculum, as a construct, has not and does not declare in theory or reflect in practice an optimum human condition which would constitute an underlying criterion for the constitution of separate disciplines in concert. Consequently, we find disciplines co-existing in a state of pathological togetherness, charitably labeled "A Curriculum." In a large sense we may apply C. S. Lewis's words, "We make men without chests and expect of them virtue and enterprise. We laugh at honor and are shocked to find traitors in our midst. We castrate and bid the geldings be fruitful."** The curriculum has developed with all the obvious appendages mysteriously affixed to a missing middle. We have set forth but our goal is not on the map.

There is no point in claiming that the preceding commentary has been other than obscure. Nor has the topic been approached with the excuse of scholarly license—the view is unblushingly romantic. The central contention is that a concept of humanness, an expression of the optimum human condition, must provide the center for the enterprise. There is no dearth of literature from which we might draw a many-sided definition of the position; the bibliography runs from Allport and Boulding through Rogers and Watts. The essence stands blatant in our own experience if we choose to view it.

The assertion may well be made that all our efforts in program reconstruction and innovation are truly aimed at making the better man, the self-fulfilling individual, the stronger central self, or as you will. In truth it may be, but one may wonder if there is more than one direction to be faced in looking to Mecca.

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*According to the new calendar proposed by Newcomer C. Visionary, in the February 1965 issue of *Clearing House*, we are now living in the year PE 7; *i.e.*, seven years after Sputnik.

**C. S. Lewis, *Abolition of Man*, New York: Collier Books, 1962.

Opportunities for Independent Study

ALVIN M. WHITE, *Chairman, Industrial Education Department, Southeastern State College, Durant, Oklahoma*

FROM the meager beginning of education in this country, the differences in educational needs of its people have been recognized. From the apprenticeship system of providing education in the three R's, developed the elementary school. Some of the young people were given only classical education since they were supposed to be the leaders, or the "ruling class" of the future.

As our educational system developed, the philosophies and programs also developed. Outstanding in the beliefs of the educators of this country is the justifiable belief that all people are different and they have the basic right to progress at their own individual rates.

Since people are so very different and have the right to progress at their own rate of learning, this writer wholeheartedly subscribes to the statement that "Needs of youth are not met by a single, uniform program of instruction." If this be true, we have all these differences in our industrial arts laboratories, and we need to ask ourselves the question, "What are the opportunities for independent study?" This is a very broad question so we will limit it to "What are the opportunities for independent study in the subject matter of industrial arts?"

In the general education part of industrial education we have progressed from manual training to a curriculum that encompasses the areas of metals, drafting, electronics, wood, power mechanics, graphic arts, etc. The areas of metals, power mechanics and electronics have grown by leaps and bounds and the technical knowledge of these areas has become more complicated and sophisticated. Since industrial arts has expanded into many more areas and these areas have become more numerous, the slow learner has the opportunity, while progressing at his own rate, to study the areas in which he is most interested and capable. The fast learner has more of an opportunity to experiment and create, using the more modern materials and processes.

It has often been said that industrial arts correlates or integrates well with mathematics and science. This is easily understood, since industrial arts makes quantitative and qualitative measurements of industrial tools, materials, and processes. Experiences in the industrial arts laboratory deal with natural raw materials, plus a large variety of new materials which were developed by science technology. Thus, the young person may gain exploratory experiences in studying and working with a host of natural and synthetic materials.

For convenience, this writer will separate the industrial arts students into three categories: below average, average, and above average.

First, let's consider the below average or slow learners. We now have several federally subsidized programs which were designed to help these individuals. These are the youth who need a great amount of individual guidance and attention from an expert teacher. They are able to perform manipulative processes, but experience difficulty in learning technical information. Shop work is more meaningful to them than abstract learning. They are limited by their ability, but if given the opportunity to develop manipulative skills in a particular industrial area, they could progress enough to be gainfully employed in the semi-skilled occupations.

The second group is the middle group in ability. We hear less about these youths, but this is the largest group and probably the one for which our instructions are directed.

If managed correctly, the project could be an asset to their learning. The individuals could be challenged not only with the manipulative processes, but with the related technical information so necessary for developing technical skills and understanding. These individuals will be able to take some facet of an industrial area and do individual problem-solving. If kept within reason, these youth could select projects or tasks guided by their individual interests.

Particularly in the area of electronics, the hobby aspect is valuable. The student who is working toward a ham license is motivated to learn about the technical and communicative aspects of his equipment. These students may be studying electronics in school, but they are studying and learning individually at home.

Third, the above average will have opportunities to integrate science and mathematics with industrial arts. This group will be developing our new materials and improving the old ones. Even though science students come forth with the ideas of their science fair projects, they need considerable advice and help in developing the ideas into reality. There is much time spent in the industrial arts laboratory working with tools, materials, processes, and products of industry. This presents unlimited opportunities for students to study in an independent manner. To this group, industrial arts will not be just "shop." Drafting will not be mechanical drawing, but will be graphical design involving the analytical processes.

Proper industrial arts programs will create a challenge in the students to not be satisfied with the minimum of learning. All students will be motivated to the extent that they will pursue new learning and experiences on their own.

Development of Creativity in Students

WADE WILSON, *Director, Division of Industrial Arts, Cheyney State College, Cheyney, Pennsylvania*

THE general theme of this conference, "Developing Human Potential Through Industrial Arts," and the theme or subject of this symposium, "Needs of Youth Are Not Met by a Single, Uniform Program of Instruction," strongly suggest the rationale of this paper, "Development of Creativity in Students."

This framework agrees with the view of Rubin who in discussing "Creativity and the Curriculum" asserts, "All human beings have some creative potential whose release produces a measure of satisfaction." This view is reinforced by Wilt who, in the lead sentence of *Creativity in the Elementary School,* states that the child with the dancing foot, the nimble mind, the hungering heart, the laughing eyes, the manipulating hands, has and is a creative spirit. Research and informational studies by Torrance and Barrow substantiate the universality of this potential creativity. If you can accept the belief that this potential is more widespread than the prevailing view that high intelligence quotient equals creative possibilities, then you accept and realize that there are implications for the school curriculum which should be conducive to fostering concepts of creativity.

Let us accept several definitions which will set the limits of approaches to the development of creative expressions (creativity) in students.

Paul Givens[1] states that: "Creativity may be defined as a uniquely human mental ability wherein an individual conceives a synthesis of an idea which is original for him, searches for meaning of the ideas, and seeks either to find their correspondence with reality or their relation to the thought of others."

MacKinnon[2] defines, "Creativity is a process which has a time dimension, and which involves originality, adaptiveness and realization."

Rhodes[3] in describing the secret nature of creativity writes that . . . "Original ideas are the by-products (1) of a human mind grasping the element of a subject, (2) of prolonged thinking about parts and their relationships to each other and the whole, and (3) of sustained effort in working over the synthesis so that it can be embodied or articulated competently."

The range of definitions and concepts is manifold. In short, when students effectively relate previously unrelated things, creativity has taken or is taking place.

The development of a unique idea, the synthesis of parts and relationship, the grasping of ideas and the sustained drive and effort which are basic to creativity are not accomplished in a vacuum. Implicit in the development of students is the view that the complex factors essential to creativity are essential to the educative process in general.

Alex Osborn, author of *Applied Imagination,* in a lecture stated, "I submit that creativity will never be a science—in fact much of it will remain a mystery —as much a mystery as is 'what makes our heart tick?' At the same time I submit that creativity is an art—*an applied art—a teachable art—a learnable art*—and art in which all of us can make ourselves more proficient, if we will."

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[1] Paul R. Givens, Identifying and Encouraging Creative Processes," *Journal of Higher Education,* Volume 33, Number 6, June 1962.

[2] Donald W. McKinnon, "Identifying and Developing Creativity," *Journal of Secondary Education,* Volume 38, Number 3, March 1963.

[3] Mel Rhodes, "An Analysis of Creativity," *Phi Delta Kappan,* Volume 42, No. 7, April 1961.

The applied art, the learnable art, the teachable arts are possible when the five specialized functions of the modern complex known as the profession of education act as a coordinated unit in providing the physical and emotional climate which is essential to the educative process, as well as being prime contributors to the creative process.

The specialized functions of teaching, administration, supervision, guidance, and curriculum development are enumerated to focus attention on the fact that the development of creativity in students is possible when the agents of a democratic society are organized and functioning with the attainment of creativity as a goal of the educative process.

Factors conducive to the development of creativity in students include: Friendly environment, an adequate physical setting, provision for choice, openness, curiosity, drive, rich experiences, flexibility in tool and material. flexibility in attitudes, self trust, freedom from threats, willingness to be and to become, challenge by disorder, freedom from tensions, inquiring attitudes, understanding the divergent, acceptance of limitations, and absence of exploitation.

Nonproductive factors are conformity, closeness of mind and spirit, preoccupation with order, exclusive emphasis on a point of view, cook-book or one-answer approach, the one-approach classroom, the robot classroom, fixed answers, lock-step, and hostile environment.

It is not intended that this paper should infer that every student can come forth through development with an original conception which has meaning to society.

Researchers have found that through a stilted approach a vast reservoir of creative ability is left untapped. Systems of education must seek to develop the full potential of every student in order that he can be as well equipped as possible to resolve the problems of the world of today, and perhaps have a basic approach to the solution of the problems of the unknown tomorrow.

Development of Creative Ability With Teachers

ROBERT A. TINKHAM, *Associate Professor, Industrial Education Division, University of Illinois, Urbana, Illinois*

TODAY we hear much about creativity and the necessity for making the most of this potential for many reasons ranging from the emotional health of the individual to the survival of our nation. Teachers, I feel, can make a sizable contribution to this effort although it may take a considerable revamping of the pre-school program to bring this about.

There are a number of situations in industrial arts teaching in which we can definitely do without creativity. I would prefer *not* to be responsible when a creative student wants to see what will happen when he strikes an arc on the side of an acetylene tank, or when another one tries to see if he can cut curves on a table saw or when still another tries to run a study on whether a spark coil fastened to the instructor's chair will lift a one hundred-and-eighty-pound man six inches or an even foot. These products of imaginative thought processes however should not remove industrial arts teachers from the group of alert, conscientious teachers in the school who are doing their utmost to develop creative abilities in their teaching of, for example, English, mathematics, social studies, and art. The dedicated teacher of industrial arts therefore accepts the challenge or admits that he is not teaching in a creative area of the school program. Please keep in mind that discussions of creativity in educational literature today do not include the kind of "creativity" found in the situation of a boy who is creating an object by following plans supplied by the teacher in a manner prescribed exactly by that teacher.

In preparing for this presentation I did some checking with some of the people in Champaign-Urbana who spend much of their time on matters dealing with creative development. Asking where you draw the line between creative thinking and problem-solving, I found that this is not easy to do. I was told by one person who is considered an authority and is frequently used as a consultant on creativity, that there is a trend in some areas to replace the word "creativity" with the term "productive thinking." I suspect that there are many industrial arts teachers who would be more comfortable with that kind of terminology, however I would warn you that you should not go overboard with the idea of producing something at the expense of the imaginative thinking that precedes, and occurs during, the making of a truly creative product.

It might be pointed out that creative people are more willing than the non-creative to take risks. Creative youngsters are, by and large, a courageous lot possibly because they have had much practice in being slapped down by a non-creative world. Creative teachers likewise need some of the gambler's instincts because they cannot be sure of the outcome of their efforts. If the teacher's goal is to have every boy achieve a certain level of manipulative performance, this can be a fairly sure thing. If, on the other hand, he is striving to develop imaginative, productive thinking regarding designing or processing, he must be ready to have faith rather than peace of mind.

There are some inherent problems in our area of instruction. Traditionally we have taught as though convergent thinking was the only way to arrive at the best solution and the only type of thinking to encourage. We have followed a perfect pattern of stressing a single method of doing something and insisting on the one and only correct answer. We ask such questions as "What is the composition of solder?" but seldom a question like "By what different methods could we fasten this piece of metal to that one?" Now granted, the student may have limited experience in answering this question, but he might reasonably conclude that the best method would be to use one of the epoxies that modern industry is using every day. The big question in all this is, do we know when to use divergent-thinking questions as well as convergent-thinking questions intelligently and do we use both to increase our effectiveness as teachers? Likewise, another question: Are we willing to put a premium on creative thinking even when it means we may not get through all of the operations slated for every boy?

Back to our main topic: How do we develop creativity in teachers? All evidence would point to the conclusion the methods recommended in the literature apply to all learners, whether they be elementary school children or teachers in training. Typical techniques include brainstorming, challenging the learner with problems for which there is no single correct answer, encouraging responses for unique problems never before faced by the learner (and perhaps by no one else either), and stimulating thought that puts together elements that had not been associated before.

If you are sincere in your desire to improve your teaching through a creative approach, I would strongly urge you to find out how you can use design more creatively and effectively by referring you to Lindbeck's *Design Textbook* published by McKnight and McKnight. I would also suggest that you take advantage of the offerings of various colleges in the country that are creatively-oriented in their theory and lab courses. I am much impressed by the work being done at Stout State University by Eugene Flug and Wesley Face.

Based on current research and on the emerging philosophies of our field, we have much to offer in the efforts being made to develop creative abilities. Action on your part should inevitably improve the learning process and as a by-product, your own satisfaction in a job well done.

Symposium—Individualized Teaching to Release Potential

How Can the Emphasis on the Student As a Person Release the Potential?

WENDELL L. SWANSON, *Department of Industrial Arts, Western Illinois University, Macomb, Illinois*

LEARNING takes place when a change of behavior results either from stimuli originating *within* the individual or *external* stimuli acting *upon* him. These stimuli are dependent upon and arise from three major forces: the person as a physical being; the social groups and orientation of the individual; and the psychological organization of the learner.

Many students are sitting in our classrooms with the intellectual ability to learn but lacking the confidence in themselves to live up to this ability. We may think of these students as being *passive* toward their environment. Learning, however, demands that the learner take an *active* part in the process. The problem for the teacher therefore becomes "How do we release this potential?"

There are at least two things a teacher might expect to do for the passive student: first, help the student to understand the control he may exert over his environment; and second, provide curriculum geared to the student so that he may have noticeable success.

Success itself may be recognized either intrinsically or extrinsically. The teacher may help the learner more clearly perceive the relation between learner-accepted goals and the learning experince; or, the teacher may devise ways for rewarding the learner. One of the strongest possible motivating forces is that of success in achievement. The student who is successful and who therefore derives satisfaction from the learning activity is motivated toward additional learning. This would suggest that the teacher must necessarily become involved with the individual and his concept of self.

We have all had the experience of standing before a group of persons, as we do in our classrooms, and delivering a paper or lesson that we have spent a great amount of time documenting, organizing, considering and reconsidering before delivery to our audience. After doing our best possible job in our delivery of the material we are quite interested in the evaluation of the results of our efforts whether this be in the form of a quiz or simply reactions of the audience. How many of us have found that the versions repeated and discussed were so far from what we intended that they became unrecognizable. Our communication was broken; one message was sent but a different message was received by each in our audience. Why? Because each and every one of us has a different concept of self.

Kelley* has explained how we perceive as follows:

"When we take in our surroundings, we take from them, not at random, but in accordance with our past experience and our purposes. To a degree, we take out of the scene those elements which will forward our purposes and also those elements which we fear may frustrate our purposes. These are the only parts of the scene which attain functional reality, and they attain it only to the degree that they are taken account of and acted upon by a person. This he can do only in relation to his experience and purpose."

From this statement we may see that the reason our audience does not perceive what we intend is that their experience and purposes were different from our own and thus perception was different.

Each of the students we are working with has his own psychological organization which is continually changing. This organization serves as an interpretative force to his perception of the educational experiences produced by the teacher. The teacher and the student do not have common interests and purposes, therefore their perception of an event is different.

If we accept behavior as being simply purposeful and directional in an individual, it would seem that perception would be selective, permitting those ideas which are compatible and resisting those which are incompatible.

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*Earl C. Kelley, *Education for What Is Real* (New York: Harper and Brothers, 1947), p. 48.

With the foregoing psychological basis in mind, there seem to be a number of avenues open to us as industrial educators in providing conditions conducive to the education of the learner.

1. If the learner believes he is being threatened, or going beyond his ability, his defenses cause him to limit his perception. This defensiveness on the part of the learner would further complicate our solution of his educational problems—we wish to broaden the student's field of possible behavior rather than restrict it; it therefore behooves us to know the student well enough to recognize a threat to the student's concept of self.

2. A student is dependent upon other people for psychological development. One of the unique features of industrial arts is its foundation in the laboratory; it provides an opportunity for the student to work with other students and with the instructor individually. Very little can be accomplished in this respect in a lecture situation. We need to take full advantage of this opportunity.

3. All people have the desire to learn. It is the responsibility of the instructor to understand the developmental tasks with which the student is working, his advancement toward these ends, and the instructor's role in the student's growth.

4. All behavior has causation, is functional, and has purpose to the individual. In the world of industry there is often more than one way to get a job done—more than one purpose. The student sees a problem from a different viewpoint from that of the instructor because he has different purposes and orientation. The student is not necessarily *wrong in his own mind* because he does not solve a problem in the same way as the instructor.

5. We as teachers must set a personal example in our own purposes and goals.

6. Instruction may be said to be individualized only when the teacher recognizes and responds to the learner's reactions as they occur.

What Occurs When the Teacher Considers the Student To Be an Individual with Unique Perceptions, Values, Concepts, and Needs?

W. T. MINOR, *Assistant Professor, Industrial Arts, Northeast Missouri State Teachers College, Kirksville, Missouri*

HUMAN potential refers to the possibility of the existence of powers not immediately obvious but latent as well as unpredictable. It is presumed that proper recognition of each individual as a unique person will cause the benefical release of this potential.

Individualized teaching is a recognition of individual human potential and the development of conditions to cause its beneficial release. For years educators have given "lip service" and superficial attention to individual differences. Individualized teaching is an extension of this recognition. It is a developmental approach which emphasizes the individual and his self-discovery. Early attempts at individualized instruction often failed because of a restrictive commitment to curriculum content and standardized instruction. Individualized instruction does not infer that students develop the curriculum—only that the curriculum and its development recognize the potential inherent in individual differences.

Actually our society "may favor individualism but consider individuality a threat to social order and a deplorable lapse of human nature, as an undesirable expression of human potentialities. At the same time we continually express our desire to develop the individual in our homes and schools while taking all possible measure to prevent or block the development of individuality."[1] A great deal of our teaching emphasis has centered on human failure and defects with a consequent neglect of human potential. Attempts to make a child into an image of some adult blocks the development of human potential by a release of the child's energy to defend his aspirations, feelings and individual capacities. Such action often develops into a lifetime resentment against authority.

The foundations for individualized teaching exist in the theories of perceptual psychology.[2] These theories have been evaluated and form the focus for several yearbooks of the Association for Supervision and Curriculum Development. The central theme of this approach is a consideration of human behavior from the point of view of the student himself as opposed to the traditional approach in which human behavior is considered from the outsider's point of view. An attempt is made to understand an individual's wants, feelings, desires, attitudes, values and uniqueness as he perceives them. Perceptual psychology stresses what occurs inside the learner and is therefore learner not teacher-controlled. For adequate behavior through perception the instructor must consider the student a dynamic organism which he assists and helps to explore and discover for personal meaning. This personal nature of learning opposes the large group-teaching situation and its resulting impersonal aspects.

Traditional academic skills and knowledge continue to maintain importance for perceptions, values, concepts, needs, etc., cannot exist in a vacuum. The important considerations are readiness on an individualized basis, development of respect for information, and selectivity based upon critical thinking and evaluation.

The foregoing points out the importance of the whole person in learning and living. Characteristics of the perceptual field of an adequate individual would include a positive view of self, identification with others, openness to experience and acceptance, and a rich and available perceptual field.

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[1] Association for Supervision and Curriculum Development, *Perceiving, Behaving, Becoming*, 1962 Yearbook, Washington, D. C., p. 16.

[2] Arthur W. Combs and Donald Snygg. Individual Behavior; A Perceptual Approach to Behavior. Revised Edition. N.Y.: Harper & Brothers, 1959.

Whatever methods or results are obtained, they must be accepted in the context of a dynamic society. Thus we realize that the individual is in a constant state of need throughout life.

For years industrial arts teachers have utilized the ideas which support individualized teaching as well as perceptual psychology. Such emphasis has been a major factor in the success of industrial arts as a part of public school general education. The individual project or experiment, individual demonstrations, the informal shop atmosphere, acknowledged industrial arts teacher-success with special education, group activities, leisure-time emphasis, etc., all are areas related to methods which support individualized teaching. Industrial arts is a field which has adjusted itself to a special consideration of each individual and has long been envied in this respect by teachers in other fields.

Recent technical emphasis and instructional up-grading as well as increased enrollments have caused many industrial arts teachers to become absorbed with the development of course content at the expense of consideration for the individual. Regardless of the excellence of content, it is no better than its acceptance, understanding and development by the student. The developments of this century have brought us to a time which requires greater consideration of the individual student's potential and the development of his willingness to accept responsibility and commitments to society. A concern for the individual was recently emphasized in the Midwest by Dr. H. J. Peters, Professor of Education, Ohio State University, who urged educators to stress the individuality of students. "To treat all students alike is a disservice to students. It's like betting on all horses in a race and all are losing."

Perhaps industrial arts stands on the threshold of greater success—not by a reduction of teaching methods which enhance the individual, but by re-evaluation and development of more effective individualized instruction.

What Occurs When the Teacher Creatively Fashions Learning Opportunities To Enhance the Students' Individuality?

JERRY C. McCAIN, *Associate Professor of Industrial Arts, North Texas State University, Denton, Texas*

ONE of the foremost responsibilities of education in America it to take the student as he is and do the best possible job to satisfy his particular needs. Developing student ability (potentials) to analyze, interpret, and correctly solve the many situations existing in the various areas of the industrial arts program is one of our major objectives.

There are certain concepts which the instructor might use in the attainment of this objective. The instructor may have at his disposal many interesting techniques, and he may want to give special consideration to the process as well as the product. We well know that if the process is not good, we cannot expect the product to be good. From the standpoint of an industrial arts education program, the basic product is "learning." Of course, the vehicle through which learning takes place is significant and must of necessity be stimulating to the learner—which happens to be the student.

Since time immemorial, man has been faced with the matter of problem-solving. His first thoughts were probably directed to *food, shelter,* and *safety.* Man first devised his tools of sticks and bones. As crude as they may seem, these first tools made man a tool-bearing creature, wherein he distinguished himself from all other animals. As these tools were improved upon, man was able to devote his energies to other activities, namely developing a system of communication, a system of counting, and a means of transporting water (a basic need). Perhaps it would be appropriate at this time to say that early man was an industrial artist, in that he developed tools to satisfy his innate needs. Thomas Carlyle depicts man as being nothing without tools, but with them he is everything . . . . Our heritage from the ancients is astronomical.

History also points out that man has long been a conformist, *not from choice but by demand. Today, our young teachers enter the teaching field bubbling over with energy and enthusiasm to get to work.* They are soon met with opposition and disappointment as their seniors superimpose upon them the traditional "salve" of conformity. *However, some thought should be given to what might happen if the teacher should become an individualist . . . .*

What occurs when the teacher creatively fashions learning opportunities to enhance the student's individuality? There are two approaches which can be made to this particular topic. However, this paper concerns itself specifically with the position of the student's behavior. There are only three possible answers as far as the student's individuality is concerned. They are as follows: 1. *Nothing*—if the learning situation, however creatively fashioned, does not present an opportunity for that individual to satisfy a need he has developed. 2. *Something bad or detrimental*—even in the best of creative learning opportunities, if good teaching is not done from start to finish. 3. *The "industrial artist"* will develop if the opportunity is creatively fashioned, and the opportunity is accompanied by friendly, personal, individual guidance by the instructor through a succession of learning activities.

Learning begins with a need. Other needs arise from something in the environment that arouses first, an internal disturbance or response which demands action. This conditioned response leads to a problem-solving response on the part of the student.

Incentives are of value in motivating learning, if the learner understands the nature of the incentive and if he has a desire to acquire it. It is important also that the teacher understand the student's individual needs in order to provide the proper incentive. What happens, or what the student does, depends largely on his own needs, the stimulus situation, his own previous experiences, and his own ability to organize, generalize, and create.

The instructor's and the student's idea of creativity may not be parallel. As an example, an instructor might creatively fashion a learning opportunity and immediately kill it by a "cook-book" type of instruction. When certain things happen, the student is instructed to do these things in 1-2-3 order. Drilling a student in pulling staples with a pair of pliers will not help him much to develop his problem-solving ability in discovering new and strange uses for the pliers. Another example of suppressing the student's potential and creative initiative actually happened: In a machine shop class, the instructor had as a project a drill press which each student was required to build. The plans called for a long belt running from the motor, which was located behind the base of the drill press, to a set of idler pullies located at the rear of the headstock and then to the main pulley on the quill. The unsuspecting student hit upon the idea of placing the motor in a vertical position, at the rear of the headstock, with means of adjusting the belt and other features. This bit of individual creativity resulted in a grade of "F" on the project for the student because he failed to follow explicit instructions. His initiative crushed, he won't try again.

In order for evaluation to be meaningful, it must be continuous. Evaluation will also point up whether or not the students have done their jobs well, and whether or not the instructor has done a good job of teaching. In any event, creativity on the part of the instructor could and should become a permanent part of the learning situation. Guiding the student in his selection of a project for investigation and assisting him in the development of problem-solving ability may enrich the program and enhance the learning that accrues.

In conclusion, an instructor must very carefully select learning experiences to provide opportunities to analyze, interpret, and correctly solve the many conditions which exist in the various areas of industrial arts today. These things through which we learn are expendable, but the learning may be more or less permanent. When the student has some selectivity in the stimuli, the learning that takes place is more permanent than otherwise. *What happens depends largely on the student's own needs,* the stimulus situation, his own previous experiences, and his own ability to organize, generalize, and create.

Symposium—The Human Potential Released by Arranging and Encouraging Desirable Interaction

The Teacher Becomes Alert to Significant Clues, And How to Respond to These Clues

WILLIAM P. LIVINGSTON, *Instructor of Mechanical Drawing, Dover High School, Dover, Delaware*

AS industrial arts teachers, we experience a great sense of satisfaction in having chosen our profession. Our field of study offers more opportunities than any other in observing clues to individual interest and talents. One of our greatest privileges and rewards is to observe creative skills develop in individual students, which involve manual performance, and are planned by creative minds. The satisfaction gained by the student as well as the teacher, through the experience of total self-expression, offers greater and fuller development. The conscientious teacher must be constantly alert to recognize these accomplishments and direct them into challenging areas.

In 15 years of teaching, I have found that the first and most important sign of student response to teaching is intelligent questions. The good teacher prepares himself to become alert to this significant clue by being enthusiastic in the presentation of his subject. He uses the salesman's technique in contacting each individual and develops interest with enthusiasm which is contagious! Students derive their enthusiasm for a subject from us, and with a few words of praise and a little encouragement, we find they all want to be engineers —well, almost!

Questions may be skillfully directed to promote intelligent discussions and thought. The good teacher plans group and individual experiences from good ideas which develop from these discussions. He encourages participation of every student, and guides discussions into valuable classroom experiences. In this way, he achieves insight into student interest and potential. He encourages opportunities, developed by such classroom study, to discover and explore these ideas through research and practical application.

One day last year, during a lively discussion on basic electricity, it was suggested that an electrical device might be invented, as a class project, to capture persons responsible for some petty thievery in our school. The ideas submitted were astounding! Some dealt with using photo-electric cells and another was to transmit sound waves to a central receiver. . . . A more practical idea was chosen to be placed in the school, and, though it did not catch the culprits, showed great originality. The boy who designed this device showed a tremendous interest in the project *and* in electricity. I am proud to say that this student, upon graduation, received a merit scholarship in electrical engineering to the University of Illinois.

When interest in a subject is shown through eagerness to please and work beyond what is normally expected, it is a clue for the teacher to recognize the student and his work. He encourages the students through bulletin-board displays of class projects and outstanding work. This visual means of recognition serves as an incentive for the student to reach a goal and improve his techniques without undue pressure from the teacher.

As an example, there is a tack board at the front of my classroom where the most outstanding drawings are posted each week. Competition for greater achievement serves as an incentive among the students. We also display on the board timely magazine and newspaper articles related to class work which the students themselves bring in. This promotes greater inerest in industrial progress and a broader knowledge of the professions related to industrial arts. Newly-discovered talents and interests lead many of my students into vocations related to the industrial arts.

A good teacher tries to promote public interest in his students and is conscious of the importance of good community-class relations. He wants his students to become acquainted with outside contacts and wants the potential of his students to be recognized by various fields of employment. The local newspaper is a valuable tool in recognizing student accomplishments and encouraging interest in this area. Field trips offer a broader knowledge of industry, and guest speakers give insight into vocations and emphasize the importance of higher learning.

Further recognition is given by arranging exhibits for the public to see. Several years ago, I entered some outstanding class work in prize competition at the State Fair. My boys took all the ribbons in the drawing division except one in architectural design which we felt we had not made a thorough enough study to enter. Later, we discovered our boys' drawings were far superior to the ribbon winners in this area, also.

The second response which offers a most important clue to student interest is the apparent enjoyment a student shows in attending classes. His eagerness to do his work well and to help the teacher indicates his love for the subject and his respect for the teacher. The teacher expects the best from his students and usually gets it.

A good teacher must have a sense of humor for his own well-being, as well as that of his students. Relaxation from tension of classroom pressures revitalizes interest and makes learning a pleasure.

When a student enters his classroom and immediately starts to work, the teacher knows he has captured the student's interest. The challenge, then, is to hold and increase interest by promoting new ideas and projects requiring greater thought and challenge.

The third clue to student response is the desire of the students for more and more additional work assignments and their obvious efforts to please and to excel. They never tire, it seems, of working at their drawing boards. These students are eager to accept the challenge of highly advanced work.

A year ago, it was my pleasure to have in my class an honor student who was not satisfied to do the required work, but constantly worked above and beyond. (This is a rare pleasure for any teacher.) I advanced him into more difficult work, thinking that the challenge would keep him busy for several days, but like a faithful hunting dog, he returned each day with the work correctly completed.

One day, he asked me for a really difficult problem to keep him busy during his recuperation at home from minor surgery. I purposely gave him a problem which I wasn't sure even I could do. Several weeks later, he returned, a bit pale, but confident with his customary grin of achievement. This prize student is now studying computers at the University of New Mexico, where he won a scholarship award.

Each student offers a special challenge to the teacher, and if he is a good teacher, he accepts this challenge with a spirit of understanding, dedicating himself to helping his students find themselves.

Education alone cannot challenge the students who pass through our classroom doors. The responsibility is with each of us as teachers to stimulate in each student the desire to learn. We must succeed in teaching them to know themselves, to think, and to accept the challenge to work toward a goal which each of them may set for himself. A good teacher must discover and analyze, evaluate and challenge, guide and direct a student's potential interests and abilities.

Along with the facts, we must constantly present opportunities for development of these facts into thought processes. Emphasis on research of class problems extends student interest into other phases of study. By relating industrial arts problems to those in other areas, the student learns to appreciate the value of his entire course of study and realizes the need and dependence of each upon the other. The perspective he gains through his industrial arts work in relation to his other studies has a broadening effect in his development At this point, each isolated subject becomes part of the whole learning process—like a picture puzzle which, when the last piece is put into place, forms an orderly, logical and complete whole. Through opportunities for self-expression and self-evaluation, a student learns to know himself in the industrial arts classroom.

Recognition, encouragement, and guidance are three of the most important teacher responses to the discovery of significant clues of potential development. He determines significant signs of response from students which indicate thought development, and channels these ideas into valuable experiences.

The Teacher Is Sensitive to Time and Timing

JERRY BROWNRIGG, *Head, Industrial Education, Northwestern State College, Alva, Oklahoma*

EDUCATORS are aware of many ways in which an individual learns and aware also of some of the things which affect the learning process. One important thing which affects how we learn and the one with which this report deals is "time and timing."

The perceptual field of a skilled worker, a gifted artist, a scientist, or a counselor does not emerge instantly, or even overnight. The perceptions necessary even for such almost universal skills as walking or talking require years for their development. Some perceptions are very fast, but they are not instantaneous even then. The solution to a problem, when it does occur, is merely the final step in a long series of differentiations which have taken a great deal of time to solve.

If an individual is suddenly confronted with an emergency, if he is placed in a situation when time for adequate perceptions is lacking, his behavior is confused, inadequate, and "unintelligent." This is because he is operating in a confused, poorly differentiated field, and hasn't had time to make wise decisions. At least, it is poorly differentiated in terms of his need. If he starts at the beginning of each moment of crisis he may never have time to make intelligent decisions. Many of these, if he is to act wisely, will have to be made beforehand. The time to differentiate, the time to solve the problem, is before the problem arises, while time is still available.

It requires *time to tune in, time to listen* and *time to respond.* For each human being, there is a flow of thought, of feeling, and of action as he interacts with his environment. He needs time if he is to become involved in this interaction. Correct meaning seems to proceed best in an unhurried atmosphere. We know that perceiving takes time and good teachers are keenly aware of this fact. They know it is possible that the pressure of speed may destroy the process of exploration and learning entirely. The value of a learning situation can be completely lost by such an emphasis upon speed that the learner is reduced to passivity while subject matter is poured forth at a rate he is unable to comprehend. Almost any student has at one time or another been exposed to the teacher in such haste to "cover the subject" that he succeeded in burying it forever.

Another aspect of time with which we are more familiar as teachers is "the right time." Right timing develops according to *interest, experience, concern,* and *personal need.* One of the best times to explore an idea is when interest and enthusiasm are high, when a strong personal motive exists, or when the solution of a personal problem suggests the learning that is needed, rather than when predetermined curriculum sets the requirement. Students not only need to be presented things at the right time, but they also need enough time to learn. For example, if a student is going to make dovetail joints on a project: A demonstration for that particular student on "how to make dovetail joints" should be given when his need and interest are high and that should be just before he is ready to make the joints, not several weeks or months previous to his need; and then enough time needs to be allowed so that the student can learn how and develop skill to perform that particular operation correctly.

Psychologists tell us, and I think it quite true, that of all the things we perceive, we perceive what is meaningful to us to satisfy our fundamental need. Though we look at the newspaper every day, it is not until we feel a need for a new home that we spend much time reading advertisements for homes. If we give demonstrations before a student feels a need for them, they are less meaningful to him because as human beings, we see what we need to see.

As human beings we perceive things which we have the equipment to perceive. However, we find that human perceptions can be extremely varied and extensive because we all differ in our ability to perceive. Perceiving takes time and with other things equal, what an individual is able to perceive in any situation will depend upon the length of time he has been exposed to the event. Many perceptions are dependent upon previous perceptions. This means that the opportunities for perceiving which the individual has had in the past must have a vital bearing upon possible further perceptions.

In summarizing, as educators we need to be aware of the importance of time and timing to students. Be aware of the correct time to present material, and then allow enough time so that students can have the opportunity to develop values and convictions satisfactorily.

The Teacher Diagnoses the Strengths And Weaknesses, the Advantages and Needs Of Individual Learners

RUFUS C. JOHNSON, JR., *Professor of Industrial Arts, Cheyney State College, Cheyney, Pennsylvania*

IN American education at the turn of the century the focus of attention was on the individual learner and what he was doing. Great emphasis was placed on the principle that learning activities should have functional or pragmatic values. Industrial arts as a discipline was a natural and necessary outgrowth of this educational trend. In a later period emphasis was placed upon the general objectives of education, and more specifically, in terms of the interests and needs of youth.

Throughout this same period, and up to the present time, public attention has also been given to the need for improved physical facilities, including buildings and space, equipment and services for education.

Increasingly, in recent years, curriculum development leaders, teachers and others are emphasizing the *development of potentialities of individuals* as the principal concern or function of education. One is constantly reminded from many sources that the fullest possible growth of the human personality is the business of education. In this continuing challenge to education the role of the teacher is set forth with increasing importance and significance. According to the Yearbook Committee of the Association for Supervision and Curriculum Development, N.E.A.[1], the teacher has the "dynamic role" of diagnosing in the classroom. The teacher is required to teach, and also to master the techniques of planning, organizing, diagnosing, directing, and evaluating the complex learning situations. The task of diagnosing is frequently compared to the work of a physician or medical specialist, who must first examine the all-important human patient, and understand as clearly as may be possible his symptoms before attempting a treatment. It is important to state that effective diagnosis requires a favorable attitude between the student and the teacher to discover and correct problems involved in the learning process. An effective bond of communication must be established between and among all individuals in the diagnostic complex.

The accomplishment of successful teaching requires systematic diagnostic procedures of determining abilities, including strengths and weaknesses, interests, and needs of the learners. *Diagnosis is the careful scrutiny of all available pertinent information gained through experience and continuous study.* The initial or general diagnosis may be accomplished in the ordinary classroom or laboratory through such means as informal and standardized tests, records, reports and individual conferences. The second and third levels of diagnosis require much more detailed analysis, and the use of special devices, and frequently other services. Here the effort is made to find out basic causes for particular problems. Characteristics of the methods of diagnosing are outlined in specific terms by Baron and Bernard in *Evaluation Techniques for Classroom Teachers.*[2]

Successful practice with any of the methods of diagnosing will depend largely upon the teacher in his control and management of the following elements: (1) The search for significant clues as to needs, interests, and abilities; (2) Continuous effort in the particular situation; (3) Critical perception of the learning process, and of contributing related factors; (4) Discovery and re-discovery of widening potential, including self-discovery on the part of both teacher and learner; (5) Cooperative endeavor throughout; and (6) The complex nature of diagnostic work.

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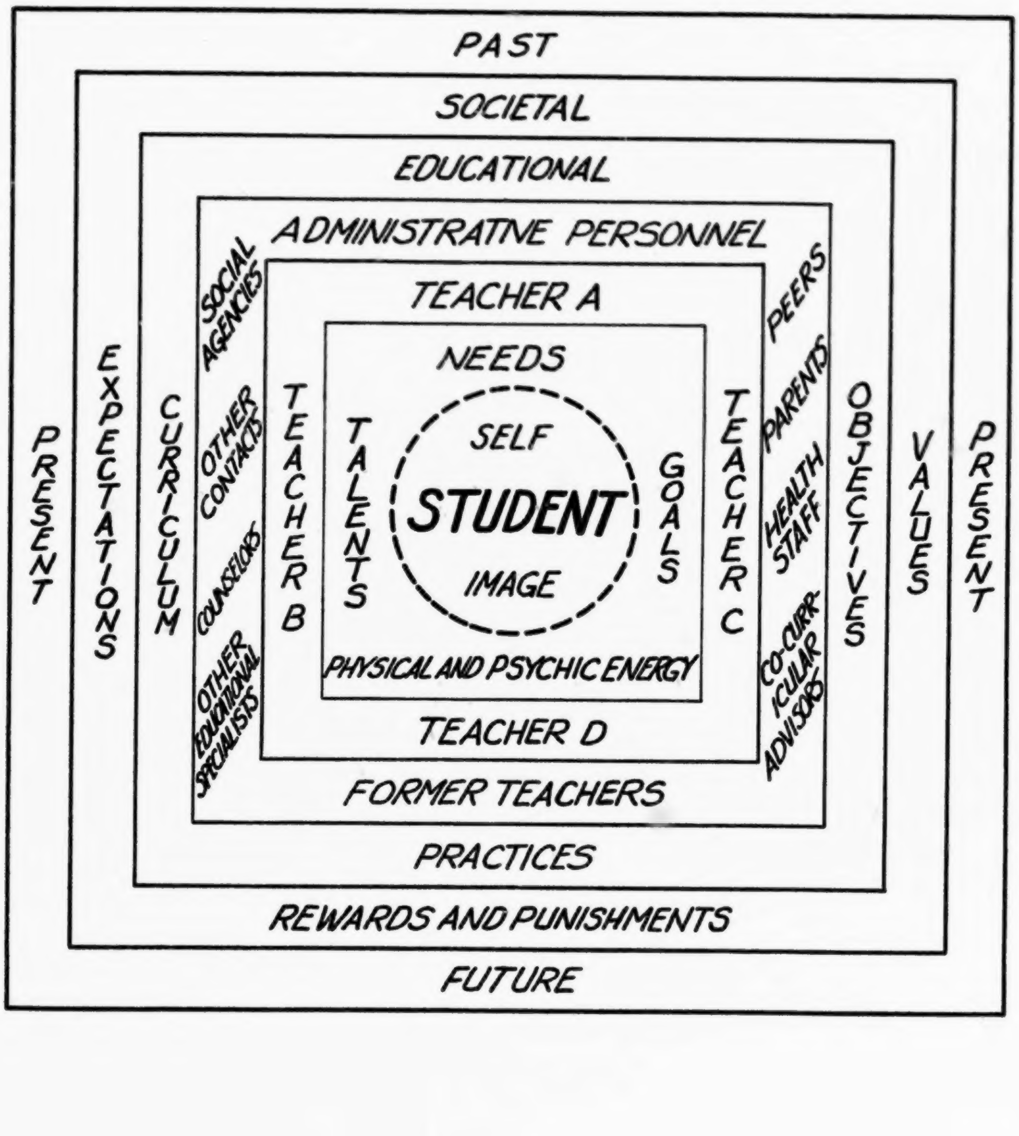
[1] Association for Supervision and Curriculum Development (1964 Yearbook Committee), *Individualizing Instruction,* Chapter 4, Washington, D. C.

[2] Denis Baron, and Harold W. Bernard, *Evaluation Techniques for Classroom Teachers,* New York: McGraw-Hill Book Co., Inc. 1958.

The accompanying *Diagnostic Complex Chart* pictures the broad elements of time, societal values and expectations, and its system of rewards and punishment. These two boundaries provide the frame of reference for understanding the learner. Next, the chart shows a more detailed view of the school and its involvement in the diagnostic process. Here we find the philosophy, objectives, curriculum and educational practices. The next subdivision lists the many groups that have direct and indirect relationships to the diagnostic process. They include administrative personnel, peers, parents, social agencies, counselors, educational specialists, health staff, advisors and former teachers. The teachers stand in close proximity to the learner and his educational development.

THE DIAGNOSTIC COMPLEX


PAST
SOCIETAL
EDUCATIONAL
ADMINISTRATIVE PERSONNEL
TEACHER A
NEEDS
SOCIAL AGENCIES
PEERS
PRESENT
EXPECTATIONS
CURRICULUM
OTHER CONTACTS
COUNSELORS
OTHER EDUCATIONAL SPECIALISTS
TEACHER B
TALENTS
SELF
STUDENT
IMAGE
GOALS
TEACHER C
PARENTS
HEALTH STAFF
CO-CURRICULAR ADVISORS
OBJECTIVES
VALUES
PRESENT
PHYSICAL AND PSYCHIC ENERGY
TEACHER D
FORMER TEACHERS
PRACTICES
REWARDS AND PUNISHMENTS
FUTURE

The learner is the center and main focus of the entire *Diagnostic Complex.* He is shown here in terms of his composite needs, talents, goals, and his physical and psychic energy. The basic needs of youth have been frequently described and analyzed, and often projected in terms of goals. The most crucial aspect of the diagnostic process is the image which the learner has of himself in relationship to all other forces in this complex.

An often-repeated theme of modern educators is individualized instruction, which in turn must be based upon careful diagnosis of strengths and weaknesses, advantages and needs of learners.

The Teacher Encourages Continuous and Self-Perpetuating Interaction

AUSTIN G. LOVELESS, *Professor, Industrial and Technical Education, Utah State University, Logan, Utah*

SHAKESPEARE declared there to be ". . . A tide in the affairs of men which taken at the flood, leads on to fortune." And then he warned, in effect, that the person who does not move with circumstances when they are ready to support his plans may leave himself only the alternative of moving against them—and of achieving, the hard way, only a fraction of what he might readily have achieved when the time was ripe. The time is ripe, and if we as industrial arts instructors have the responsibility that the title of this paper suggests, to encourage continuous and self-perpetuating interaction, then we are faced with making some changes or finding ourselves moving against the tide.

Let us look at some of the common, everyday experiences and practices that often violate the principle of interaction. Many practices in the typical industrial arts laboratory are in fact interferences with a natural, continuous, interactive learning situation. A typical example is the course of study made up of separate, unrelated subjects, with little or no attempt being made to relate the learning to the current life of the learner. In most instances, little attempt is made to relate the subject-matter learnings even from subject to subject.

There are many violations of the principles of interaction. They include such things as sequence of courses, assignments, grading system; and finally, many teacher-training institutions violate these principles by giving their trainees devices, gimmicks, and techniques instead of principles and understandings basic in the learning process.

So much for the negative side of the ledger. Let's look at the positive side. We are cognizant that all experience in and out of school involves interaction with persons and things. It is generally understood that we consult persons, refer to books, use materials, visit places, observe processes, and participate. All learning is directly affected by the availability and accessibility of persons and materials, and by the use made of those which are accessible. It is our job as industrial arts teachers to make our students aware of the fact that they do not merely use the environment they live in; they mutually interact with it. They do not live in an environment; they live with it. The individual is not in his environment as bricks are in a wall, not as oranges are in a box. He is in his environment as a plant is in the sunlight, and as sunlight is in the plant.

The teacher must accept a dual role in carrying out the responsibility of encouraging continuous and self-perpetuating interaction: First, that of a resource person; and second, that of coordinator. It is felt by some people that actually all a teacher can ever be is a resource person. Unfortunately, oftentimes he is less. Learning is ultimately a private affair, even though this interaction between student and teacher frequently is a contributing factor in the process. The idea that the teacher is primarily a resource person is not new but is merely being revived. The prime reason for the revival of the idea comes from the realization that we have proceeded to a point where the accumulation of "facts" in certain fields—science and technology—and the shortened "life" of these "facts" before obsolescence are creating a problem that is difficult for the student to comprehend. We read in the newspapers, weekly magazines and professional journals of the problems faced by workers at all levels of training in keeping up to date with the advancements and changes in their fields. John Fischer, in an article in Harper's, asked if the distribution of intelligence now required by our technological society is inconsistent with the distribution of intelligence inherent in our population. We might ask, then, what changes in teaching must correspond to changed learning needs.

The teacher will need to learn to function differently in order to promote a different type of learning. Emphasis will need to shift away from the mastery of *old knowledge to techniques* for developing access to new knowledge. This is not to say that existing knowledge is not important but to say that we must reorganize our thinking.

The teacher in the role of a resource person acts less as an authoritative figure than has been the custom in an autocratic classroom. The teacher, as well as his students, can no longer be expected to have extensive knowledge of all phases of the broad and expanding field of technology. His main function will be that of directing student inquiry and in creating and maintaining an environment wherein learning is maximized. In the field of industrial arts, this may take the form of an organized program of American industry similar to the program that is now organized and being studied at Stout State University. We should all watch with interest the results of this research for it may point the way that we will be moving in the decade ahead.

It is plain to see that the teacher's role will be highly professional, for much of the classroom activity will be open-ended with no set of known directions. The teacher will be the operational curriculum writer or developer and will not abdicate his role to absentee textbook publishers or to supervisors.

The second phase in this dual role mentioned earlier—that of coordinator—

is equally important in encouraging continuous and self-perpetuating interaction. With the rapid increase in knowledge and the continuing changes characteristic of society today, education is and must be a life-long process. If we can accept as the prime task of the schools of today the obligation of equipping students with the desire and ability to continue the quest for understanding and for competence, then the teacher must provide experiences to enable the learner to interact with the world he lives in. The teacher can accomplish this by properly coordinating or programing the use of other resources and thus create an environment of learning. Guest speakers are one such resource. Not only are local communities a source of persons whose knowledge can be integrated by the teacher, but regional and national organizations are providing personnel as well. This could very well be an area of activity in which our own American Industrial Arts Association should expand. Other subject-matter fields have many fine activities, of which we are all aware, that have contributed much to this interaction between students and the world they live in. To cite a few of these activities: science weekends, where students undertake work under the guidance of field specialists; summer work experiences for students, summer and Saturday study programs, tours, in-class demonstrations, lectures, and the development of supplementary materials for student use, cooperative programs with universities: all are a part of the coordinating function of the teacher.

In the above instances, the decision-making role is largely retained by the teacher. Curriculum, however, is vitally affected by his coordinating activity, even though it may appear that he is a step removed from the learning process. It is as a resource person and coordinator, above all else, that the teacher may make a claim to professionalism.

Some Problems in Getting Sponsored Research Projects

RALPH GALLINGTON, *Chairman and Professor of Industrial Education, Southern Illinois University, Carbondale*

THIS presentation would not propose any unique guides by which one is assured of success when it comes to seeking sponsored research. People who have had experience and success in getting research projects would be the last to suggest that there are any foolproof procedures to follow. At the outset we must accept the fact that the most successful grant recipients will have written and rewritten many proposals and will have been turned down many times. I hope this paper will not discourage many young researchers who have great potential and interest. Perhaps it might be said that some of the measures of great potential in research are perseverance, patience and resilience, as well as interest, abilities and capacities.

Getting Research Under Way

In this particular and scholarly type of work many teacher-educators are almost totally unprepared. Research methods courses are of some help, and of course, the preparation of theses and dissertations are good preparatory experiences. These alone have been found quite inadequate, however. Certainly it may be said that very few people who have had both course work and dissertation experience in research are going to make good researchers.

One of the finest experiences for a young researcher to get is an assignment with an older and/or experienced researcher. In this way the young researcher will be able to see the many difficulties and responsibilities to be expected in research directing. Sometimes this experience is afforded to graduate students acting as research assistants to research professors. Others would do well to seek out the research-active professors in their institutions and volunteer to become a very minor assistant. Before one "takes off" on a research of his own he should have worked as a member of several research teams.

The young researcher with team experience should also learn the technique of building a team for his own sponsored research. His assistants will then be gaining experience which will enable them in turn to become researchers later in their own right. Further, the team is essential to the director's success. To build an effective team to conduct research is one of the major administrative duties of the research director.

The research director is an administrator. Generally he recruits his staff or team and gets them appointed in advance so that the timetable for the research may be met. Usually he must be familiar with salaries of typical personnel. Generally, the institutions will have policies on this, but occasionally special services may be needed and contracts will have to be negotiated with key people to work on the project.

In addition to the budget for staff, the other costs must be estimated and proposed. Transportation costs, car scheduling, office supplies, computer services, telephone service, equipment costs and needs, printing and binding of report are a few. As a proposal develops, all of these costs must be kept in mind.

The researcher is a responsible person. His qualifications are usually the key to whether or not the grant will be given. His background and experience are important to the funding agency. His judgments of costs are considered and reviewed with him. Unless he is fortified with plenty of justification for his estimated budget, he may lose the grant. Moreover, he will be expected to produce results with the grant he has been given. If, for example, he later has to come back with requests for supplemental grants to complete the project, his reputation is being established in an unfavorable light for future grants.

Proposals

All research grants are initiated by proposals. Most funding agencies will furnish directions or forms which will guide the researcher. These should be followed precisely. Every word must be studied and interpreted. If there is any doubt as to the intent of certain directives, the researcher should call the agency for a clarification.

Some colleges and universities provide a service to prospective researchers in developing the appropriate application and proposal. It is best not to rely entirely on this service in many cases, because the service itself may be less qualified than the researcher to interpret directives. Most of these services have been developed and established recently and staff is not experienced or very understanding of research principles and methods.

Needless to say, proposals for funded research should reflect the work of a very scholarly person. It should be his finest writing and the presentation should be good-looking. The proposal should be presented with the knowledge and approval (in writing) of someone who represents the administration of the institution. Most colleges and universities have a person designated for this responsibility. And the proposal itself in the proper number of copies will be forwarded generally by the person responsible for approving the proposal.

Some deterrents on your own campus: (1) People who are not familiar with your problem may also be opposed to it unless you do a good exposition of it. Even then you may meet opposition on your campus. (2) Your own colleagues may oppose your getting released time to do research. (3) Turnover in personnel due to sudden advancements and resignations may leave you without help or support. (4) You may spend many hours waiting in outer offices. (5) The funding agent's form for reporting. A proposed budget may be incompatible with the institution's accounting system. (6) Too many institutions want to hit the funding agency for excessive charges. (7) You will spend many hours rewriting sections of your proposal to conform to the requirements of both the funding agent and your own institution. (8) You may be denied any contact with a representative of the funding agent, and uninformed personnel on your own campus (designated to negotiate for you) can often make some terrible mistakes, causing your proposal to be turned down or tabled for future consideration. (9) Until a grant is made, you may find yourself carrying a full load; with the strain of working on your proposal, you will probably be working an unreasonable number of hours per week. (10) When the grant is finally received you may find that the released time afforded you is unsufficient.

Some helps on your own campus: (1) Some research offices afford counsel and assistance in preparing proposal. (2) Some research office personnel are extremely well-informed and dedicated people who make your work seem important and compensating. (3) Sometimes research offices have access to funds to advance for getting research under way. (4) Your own colleagues may wish to assist in some way and become members of your team. (5) Your school through the research office may actually bring research to the campus and recruit your aid in conducting it.

Some deterrents from funding agencies: (1) Committees made up of persons with a wide variety of interests may review your proposal. (2) Few if any members of the committees may have any knowledge of your subject and its importance. (3) If proposals are sent back for rework, the criticisms of the committee may appear to be overwhelmingly discouraging. These critics are brutally frank. (4) Often the opportunity to rework appears to be a consolation prize rather than any act of encouragement. (5) Frequently you are unable to contact anyone who can give you any specific directions for improving the proposal so that it might possibly be approved on the next go-around. (6) The person to whom you are referred may be hard to contact, seem disinterested. (7) You may be accused of having exclusions which were actually overlooked by the committee when it reviewed your proposal. (8) You may be criticized for not giving a rather complete statistical treatment or you may be criticized for making your proposal a statistical maze which covers up the real problem and your main research design. (9) Funding agencies may expect colleges and universities to "put in" time and/or money, in order to get a grant. Sometimes this demand is considered excessive by the institutions.

Some Funding Agencies

1. Federal Agencies
    a. Department of Health, Education and Welfare
        (1) Cooperative Research Program
        (2) Educational Media Program
        (3) Handicapped Children and Youth Program
        (4) Language Research Program
    b. Agency for International Development
    c. Atomic Energy Commission
    d. Department of Interior
    e. Housing and Home Finance Agency
    f. National Aeronautics and Space Administration
    g. National Science Foundation
    h. Office of Economic Opportunity
    i. Veterans Administration
    j. Department of Labor
2. Other Agencies
    a. Ford Foundation
    b. Rockefeller Foundation
    c. Duke Endowment
    d. Hartford Foundation
    e. Kellogg Foundation
    f. Carnegie Corporation of New York
    g. Sloan Foundation
    h. Moody Foundation

AMERICAN COUNCIL FOR ELEMENTARY SCHOOL INDUSTRIAL ARTS

The College Education of Elementary School Teachers in Industrial Arts In Various Sections of the United States

Elementary School Industrial Arts At Trenton State College

ROBERT G. THROWER, *Associate Professor and Coordinator of Industrial Arts for Grades K-6, Trenton State College, Trenton, New Jersey*

ALL of us here today are committed to the belief that industrial arts has a worthwhile contribution to make to the education of elementary school children. However, some of us probably would disagree on the approach which would best achieve this goal. I, for one, am convinced that with the Gestalt theory in vogue and the majority of elementary curriculums based upon the unit method of instruction, industrial arts in the elementary school can be of ultimate value when it is treated basically as a method and is an integral part of the various units.

Based upon this approach, I sincerely believe the key person to be the classroom teacher. This is in no way to belittle the importance of the contributions of the elementary school industrial arts specialist or consultant. I hold to this belief concerning the classroom teacher because this is the one person who intimately knows the students in his or her class and at the same time the program of studies planned. This being the case, I feel the classroom teacher is the one person who can most intelligently select the industrial arts activities which will be most appropriate. In order to make these decisions and then to be able to carry them out, the classroom teacher must have some training in the use of appropriate tools and materials.

For this reason, at Trenton State College, we provided the opportunity for all kindergarten-primary, elementary, and special education majors to become acquainted with industrial arts. This is done through two phases of their program of studies. The first phase is in their program of general education. Here they must choose between a fine arts course or an industrial arts course designed for non-industrial arts majors as one area of the humanities. Some two hundred students a year choose the industrial arts course which is taught in a general shop setting. In this course the students get a good overview of industry and its function in our society. In addition, the students may elect two additional courses in the industrial arts curriculum in the elective part of their program of general education. A good number of students exercise this option each year.

The second phase is in the area of professional education. In this area we offer a course entitled Tools and Materials for Grades K-6. It is a two semester-hour course which meets four hours per week and is aimed especially at the prospective kindergarten-primary and elementary teacher. This course is elected during the junior or senior year by over fifty per cent of the elementary and kindergarten-primary majors. The objectives of the course are: (1) To become knowledgeable about, and competent in the use of, appropriate tools and materials for the elementary school. (2) To become cognizant of the place of industrial arts in the elementary curriculum and the functions of this phase of the curriculum. (3) To develop an understanding of the role of the classroom teacher in a program of industrial arts in the elementary school. (4) To develop the ability to organize and carry out construction activities in the elementary classroom.

This being a laboratory course, the major portion of the class time is spent with the students actually working with the tools and materials. The objects which they construct are items which relate to typical units which are taught at the various grade levels. These are activities which the elementary children could actually do themselves. Both individual and group projects are done.

A second course offered in this area is Industrial Arts Methods in the Elementary School. This is a three semester-hour course which consists of two hours of lecture and two hours of laboratory per week. It is a continuation of the previous course with emphasis on the construction of units and the various methods of carrying out construction activities in the classroom. As a part of this course the students go into some of the local elementary schools and work with a classroom teacher and pupils on a construction activity. This course can be taken by advanced undergraduates or graduate students.

With this background of training we believe these future kindergarten-primary and elementary teachers are capable of utilizing the values of industrial arts in their respective classrooms. We face the immediate future with the optimistic hope that at least one of these courses, Tools and Materials for Grades K-6, will become a required part of the undergraduate preparation of every kindergarten-primary and elementary teacher at Trenton State College.

For the industrial arts major who is interested in becoming proficient in teaching industrial arts at the elementary school level, Trenton State College offers two elective courses. The first is the Industrial Arts Methods in the Elementary School which I have previously mentioned. The industrial arts major learns how to apply the tool skills which he has already acquired to the elementary child, and the elementary curriculum. He develops an understanding of the role of the consultant, and competency in working with elementary teachers and children. This is accomplished by having the industrial arts major spend two or three hours per week in a local elementary school observing classes, consulting with teachers, and helping with classroom construction activities. His class time on campus is spent becoming familiar with appropriate materials and tools and how to use them effectively with children.

The other course for industrial arts majors is a graduate workshop in Industrial Arts for Grades K-6. This course is especially for teachers in the field who are teaching in K-8 elementary schools. Basically their teaching load is with the seventh and eighth grades, but in our state they are frequently asked to extend their program downward through the lower grades. These teachers are somewhat at a loss as to the best approach to take as they have had no training in this area. This course provides them with the opportunity to learn how to effectively operate a program of industrial arts in the grades. Attention is given to the elementary curriculum and to the nature of the grade school child. In addition to the group of teachers, others who have an interest in this level of industrial arts are welcome in the course. This course capitalizes on the talents of guest lecturers from the education department on our campus.

This constitutes the offering of Trenton State College in the area of elementary school industrial arts at the present time. We are by no means content to let it remain so. With the increasing interest in industrial arts for grades K-6 in the State of New Jersey, Trenton State is already working on expanded offerings in this field.

Elementary School Industrial Arts at Georgia Southern College

WALTER ROLLIN WILLIAMS, III, *Associate Professor of Industrial Education, Georgia Southern College, Statesboro, Georgia*

THE recess bell rang and two boys ran out of a new, air-conditioned school to play. While the boys were playing, a modern jet airplane flew overhead. The boys talked about the payload of the plane, its thrust, the cost of the plane and its range. The educational requirements of the crew and their responsibilities were discussed in relation to flying the aircraft. Before long the school bell rang and one boy said, "Back to stringing those sorry beads again."

This little story hits home because some people consider elementary school industrial arts just "stringing beads." Is this elementary school industrial arts?

Carter Good, in the *Dictionary of Education,* indicates that elementary school industrial arts is "informative and manipulative work offered in the first six grades, involving tools, materials, processes, and products of industry as they relate to home and community life."

The key words in the definition are informative, manipulative, and industry. Elementary industrial arts is more than the construction of objects, such as bookends, ash trays, and baskets.

In a review of literature at least fifteen objectives of elementary school industrial arts may be found. Some of these are: Avocational and recreational interests; expression with a large number of materials; appreciation of different cultures and people; consumer knowledge; muscle development; social development; recognition of abilities; reinforcement of basic subject matter; study of industry; and study of tools, materials, safety, and occupational training.

All these objectives have merit, but what objectives are unique with industrial arts and what type of program can do the most for its students? Should it be craft-oriented, industry-oriented, or what?

Elementary school industrial arts must be concerned with several basic concepts. The following should be included in the areas of study:

Investigation. The student should be provided with an opportunity to investigate in his schooling. He should have the opportunity to find out the *why* of things, using sound investigative procedures that can so easily be developed in elementary school industrial arts.

Experimentation. There is a need for increased emphasis at the elementary school level for more effective use of industrial arts in the development of problem-solving activities. These experiences might center on products and materials used in industry. The pupils should have an opportunity to experiment, create, and work with industrial materials.

Basic understanding of industry. The study of industry should be stressed to a greater degree in the elementary school. Industrial arts activities such as building replicas of inventions, industrial plants and machines, and developing line production projects, models, and industrial flow charts, are not being used in many present programs.

This topic is concerned with teacher education in elementary school industrial arts. Because I am most familiar with the program at Georgia Southern College in Statesboro, Georgia, I will confine my remaining remarks to that institution. Georgia Southern is a college of about 3,000 students. The major facts concerning the elementary school industrial arts program of this school are: (1) Elementary school industrial arts is required of all elementary majors in junior year (5 quarter hours). (2) Approximately nine sections with a total of 225 students are taught each year. The course consists of nine periods each week for twelve weeks. (3) The format of the class includes: Lectures based on methods of instruction and tool skills, plus an intensive study of several major industries; laboratory work involving individual projects (tool and material skills) and unit projects; each student develops a written unit, and constructs a unit activity around it. (4) Other elementary industrial arts courses offered at Georgia Southern are:

A. American Industries: 15% elementary majors.

B. The World of Work: Graduate course for elementary teachers.

C. Basic Industries Practicum: Graduate course for elementary teachers.

Elementary School Industrial Arts Education At Eastern Michigan University

CARROLL A. OSBORN, *Associate Professor of Industrial Arts, Eastern Michigan University, Ypsilanti, Michigan*

EASTERN Michigan University, like many another respectable institution, takes pride in listing several "firsts." The original building was dedicated in the fall of 1852 and instruction began the following spring; known as the State Normal School, it was the first state institution for teacher education west of the Alleghenies. Eastern was the first college in Michigan to offer work in industrial arts.

The first teachers' course in elementary school industrial arts was offered by Alice I. Boardman in the summer of 1902. Professor Boardman had joined the staff of the laboratory school the previous September as a specialist and consultant in manual training and kindergarten method. This was the beginning of the manual training department; in 1915 the name was changed to industrial arts. By that time, the department was firmly established and had grown to include the preparation of high school teachers.

It is significant to examine the forces which produced this pioneer program at the turn of the century. Perhaps foremost among them was a faculty which possessed a well-grounded understanding of philosophy and psychology of education. And this, of course, included an understanding of the functions of manipulative activities in elementary education.

The doctrines of both Pestalozzi and Froebel dominated much of the thinking of leaders in education in the nineteenth century. For example, here is a portion of the annual report for 1876 of the laboratory school director, Daniel Putnam:

"During the year just passed we have made considerable use of kindergarten material in the lower primary classes. We have not attempted to establish a regular kindergarten, but have rather sought to learn what value the gifts, so-called, may have in a primary school. I am satisfied that many of the gifts and plays of the kindergarten can be introduced with great advantage into the primary departments of our graded schools, and even into our common district schools. The kindergarten is founded upon principles in harmony with the nature of childhood, and is destined, I have no doubt, to produce, sooner or later, a complete revolution in the manner, means, and methods of elementary education."

To those of us who are impatient with slow progress, it is comforting to note that it was thirteen years from the date of this report to the establishment of the kindergarten. It was also thirteen years from President Sill's first plea for a manual training teacher until Miss Boardman's appointment. However, these delays did not prevent practice and experimentation with new developments in educational theory.

Since then, newer insights into the nature of learning have become well known. The connectionist and Gestalt schools of psychology, and the philosophy of Dewey each have influenced the character of the course offerings, as have the works of Bonser, Mossman, Newkirk, and others.

One important principle appears to have been in operation continuously through the years. It occurs over and over again in lectures, syllabi, demonstrations, final examinations, course descriptions in the catalog, around the coffee table, and in scholarly apologetics. It is this: Elementary school industrial arts is both subject matter *and* a method of instruction.

This is not an easy concept for every undergraduate student to understand fully and to practice. Indeed, some informal studies of the proceedings of certain university committees indicate that not every professor of education fully understands it either. No doubt part of the difficulty lies in the problems of teaching for cognition.

At Eastern Michigan University all undergraduate students in the elementary teacher curricula complete what is known as the "arts group minor." This has been the practice for many years; in fact, it has the earmarks of an "old college tradition."

The arts group minor is made up of the following:

			semester hours
Fine Arts	101	Introduction to Art	3
Music	104	Elements of Music	2
Industrial Education	253	Industrial Arts for Elementary Grades	3
Fine Arts	300	Creative Arts	3
Music	320	Early Elementary Music Education	3
or Music	321	Later Elementary Music Education	(3)
Industrial Education	354	Industrial Arts for Elementary Grades	2
		Total	16

About 30 per cent of the elementary education students choose to add dramatic arts, dramatic arts for elementary grades (3 sem. hrs.), and five hours of electives from fine arts, music or industrial education, to complete the arts group major. Certain courses in home economics and physical education (dance) can also be used as electives.

The first elementary school industrial arts course (253) meets for three hours each week for three hours credit; the second course (354) meets two hours a week for two hours credit. This means that a good deal of work has to be done outside the laboratory. Work rooms in dormitories, equipped with some small tools, work tables, and, in some cases, jigsaws, enable students to work on their own or in groups. They can also attend free-lab hours which are open to all students. Special help is available during the staff members' office hours.

The absence of long laboratory periods has some disadvantages, but it is a practical way of limiting the size and complexity of projects, thus encouraging the types of things that can be done in the ordinary elementary classroom; and the instructors and the laboratory can serve a maximum number of students.

The projects, problems, and activities of both courses fall into three classes. There are a few which are purely arts and crafts. There are teaching aids and demonstration devices, such as form boards, electrical question-and-answer boards, folding felt boards, various forms of the abacus and other arithmetic aids. However, by far the major emphasis is upon projects with correlative or integrative possibilities.

For convenience, this latter category is referred to as unit projects. Such projects are for use in learning science, social studies, music, arithmetic and geometry, social science, language arts, and technology. They must be designed so that in practice the future teacher could use them in some particular learning situation or unit. The student must explain how the activity can be used to "motivate learning by providing the child with reasons real to him for counting, computing, reading, writing, observing, thinking, and planning." He must also consider how the development of desirable habits and attitudes can be involved, as well as making some advances in the understanding of our cultural heritage and our technological society.

The catalog of unit projects is too long to list here, but some typical examples are these: Typography and lettering; sketching and drawing to scale; papermaking; fabricated paper projects such as portfolios, boxes, model shelters, booklets, bookbinding; paper decoration activities—marbled, appliqué, potato prints, crackle-dye; papier maché; plaster casting and modeling; spinning and weaving; woodworking—bird houses, Early American utensils, horn books, easels, puppet stages, miter boxes and jigs; metalworking, tin can projects; maps, globes, and charts—foam rubber, crayon on muslin; panorama and diorama construction; candlemaking, soapmaking; electromagnets, electric motors, simple radios; models, mock-ups, and displays; and character dolls and puppets—embroidered, painted, and lacquer features.

At the graduate school level there is one advanced course in elementary school industrial arts. For those who have had no undergraduate course work in the subject, there are provisions to earn some graduate credit by taking the undergraduate courses.

Elementary Industrial Arts Education At Ohio University

ROBERT H. HAWLK, *Associate Professor of Industrial Arts, Ohio University, Athens, Ohio*

INDUSTRIAL arts for the elementary school, as taught at Ohio University, is based upon the value of the individual student who possesses the ability to originate teaching techniques that will foster the goals of elementary education. Diversification of backgrounds, found in each class of elementary majors, constitutes the strength of each group when planning original projects. Elementary education concerns itself with many aspects of living just as differing backgrounds represented in the college class were the result of diverse socio-economic levels and geographic locations.

The class is primarily designed to serve elementary majors. As an elective it has attracted many students each semester. Support is given for the course by counselors in the department of elementary education because they believe in the values to be derived from participation in this type of educational preparation. During the summer sessions the course has been particularly popular with teachers returning for more education. These elementary teachers bring realism to their work and keep the course up to date in regard to trends in the field.

Working in three dimensions, on projects of original design, has proven to be a new experience for the majority of the students. Educational material used in most courses was two-dimensional; the new experience with the third dimension provides a unique opportunity. To most students, industrial arts as a phase of education has been a mystery. A natural curiosity is evidenced regarding the techniques of using common tools in an educational environment. Even though power tools are not usually found in elementary education, with the exception of a small jigsaw, college-level students want to know about their operation. These factors are taken into consideration when plans are made for conducting class activities for elementary majors.

Distinct needs are evidenced by elementary majors who elect industrial arts classes. The first is a need to develop understanding regarding the place and purpose of industrial arts in the elementary school. Another primary need is to develop facility with tools in order to teach with some degree of assurance. A multiplicity of needs includes a desire to learn more about the world of industrial power as applied in fabrication of consumer products. Simply stated, the future teacher of elementary children wants to use every possible means for preparation that will be of greatest value when he has become a professional. For this reason, instruction and experience is provided with both hand and power tools as related to the projects being constructed. The hand-tool instruction is given to provide a background for actual teaching in the elementary school. Power-tool instruction is given with some selected experiences in order to enrich the industrial background of the student.

When a new class meets for the first time, the students learn about one another by exploring their own goals and understanding regarding the elementary school. Individual plans are made for teaching a unit of work for a particular age group representative of elementary education. Industrial arts activities are organized within this unit of work. Projects that are to be made by the college students are exactly the kind to be made by their future students. In the period of time devoted to elementary industrial arts, it is difficult to make more than two representative projects. It is understood that these projects are not the only ones that might be developed by students of elementary age.

The course is enriched by experiences with power tools such as the planer, table saw, and joiner. A jigsaw is used much in the same manner as it would be used in elementary schools. The more hazardous power tools are not taught as a phase of industrial arts in the elementary school; rather, they provide the means for teaching the industrial aspect and the proper use of power. Safety, proper adjustments, and thinking in advance before the application of power are a few of the learnings that may accrue from experiences with power tools.

As it is difficult to plan intelligently prior to having at least elemental experiences with hand tools, planning of original projects is deferred until the instruction has been given for proper use of hand tools. This is followed by instruction in planning, including some three-view drawings. Materials selection, measurements, and logical procedures constitute the next phase of the work. This proves to be one of the most problematical phases of the class. When this is conquered, the students emerge as more independent thinkers because reality has been added to theory. It is at this point that industrial arts activities are understood as a valuable asset to elementary education.

Refinements in understanding and skill development continue to the last few weeks of the class. When all the students have completed their unit of study and their representative projects, the entire class views the completed work. Each student presents his individual planning as well as the industrial arts projects used to implement the study. If musical instruments have been made, they are played for the class. Each student becomes an elementary child for a few imaginative minutes and the elementary school is recreated in the college classroom. We live it as well as just prepare for it.

In summary, industrial arts for the elementary school at Ohio University is based upon the premise that each student will find it possible to perform in a unique and individual manner, just as the students who will be taught in the future by these college students will be individuals with their own goals and aspirations.

Elementary Industrial Arts Teacher Education In Washington

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THE development of college elementary industrial arts programs in the Pacific Northwest is very limited. Only two of the five state colleges and universities in the State of Washington have courses specifically designed for this purpose. I am certain others have service courses that aid in the training of elementary teachers, but to my knowledge there isn't any special emphasis placed on this phase of industrial arts. In Montana, Idaho, and Oregon I cannot report any programs of this nature and a recent check of most of the college catalogues tends to confirm this statement.

To the best of my knowledge we do not have any elementary industrial arts supervisors in any of the public school systems in this section of the United States.

Western Washington State College at Bellingham has had a fine elementary program for a number of years under the guidance of Edna Channer, who teaches in both the art and industrial arts departments. Eastern Washington State College has had a program in recent years in elementary industrial arts.

The same problems face us today as those Mary-Margaret Scobey wrote of in the February 1965 issue of *The Industrial Arts Teacher;* the two major problems were "First, the confusion among educators as to the definition of or concept about industrial arts at the elementary level; and secondly, there appears to be no effective program accordant with a broad concept of industrial arts and unique to the specific characteristics of the elementary school curriculum." Thus, eleven years later we still find much work to be done in convincing administrators of the worth of this activity and to promote programs by clearly stating the objectives.

Other sections are able to point to outstanding programs in nearby cities, but Los Angeles, Kansas City, Roslyn, N. Y., and others that could be cited do not have much impact on programs in our schools.

Now let me briefly explain our program. First, I would like to preface my remarks about our own program with the statement that we cannot claim any unique innovations. We have endeavored to base our program on the same sound principles that this council has fostered. Basically, we endeavor to give the elementary teacher, or prospective elementary teacher, background in five major areas; namely, the concept of industrial arts in the elementary school, basic tool processes, construction activities in group experience units, projects in areas of special interest and in crafts and planning for industrial arts in the elementary grades.

In the first area we clarify the nature and purpose of elementary programs. The students gain an insight into the program that is totally different from what most of them have ever thought of or heard about. Many faculty members in education departments still conceive of the program as that of "squaring a board" for the sake of making a tie rack or a door stop. This was often their only industrial arts experience.

The emphasis placed on proper use of tools and the basic tool processes for different maturation levels is considered an important area. Too often, we have found in aiding teachers in the field that there is little understanding of the large and small muscle development for motor activity. A comprehensive study is made of this phase of child development so prospective work will fit the grade level.

The next area is to me the backbone of modern elementary industrial arts. When we can make it easier for elementary teachers to plan and have their students build good group experience projects much of the "selling" of this area of education will be accomplished. The students must carefully plan and then construct a sample group experience project. They are to use the same tools and materials that would normally be available in grades K-6.

For the special interest and craft area of instruction many unique projects are made—projects ranging from the abacus to the zither or like instruments are constructed. In the craft areas only short-duration and low-cost projects are developed with the emphasis on the interest span of younger children.

The phase of planning for elementary programs emphasizes realistic approaches to providing these activities in our schools. In the Northwest as in all other areas of the United States, the problems of space and finance weigh heavy upon implementing the program we endeavor to foster. The teachers that can improvise and plan economical laboratory experiences will have a much better chance of promoting this area; therefore, it is imperative that we give them a sound approach to classroom arrangement and tool and material acquisition.

This course is coordinated as closely as possible with our campus school. Even in this situation we hear the same problems of lack of time, lack of supplies and materials and teacher's lack of expressed interest, as I am certain all of us encounter at various times when we endeavor to promote meaningful experiences in K-6.

Group experience projects include the building of a fort in Indian country; earth science (map making, conservation); setting up a lumber mill; modes of housing and transportation.

Integration of a project with a second grade unit includes the study of birds; start of instruction in construction; craft projects; power development; making a model of an automobile chassis.

We have only started to establish a frontier in the Pacific Northwest and much pioneering needs to be done before we'll be able to report any substantial progress. We will be looking forward to all of the help we can get from the council and I can assure you we do have some worthwhile activities going on in elementary schools, but too many times they are exceptions rather than usual practices. The reverse of this is our aim as I am certain it is of all who assembled at the AIAA meeting in Tulsa.

The Use of Industrial Arts in Extending Elementary School Subject Matter

Introducing Elementary School Children To Industrial Processes

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IT seems as though industrial arts activities in elementary school classrooms need to strike a balance between correlating with classroom work and making a unique contribution. If there is no attempt to correlate with other classroom subjects it is more difficult to justify the time devoted to industrial arts activities. In the other extreme, if the only value is to provide a medium of expression, a unique contribution may be lost. A balance between correlation and the unique contribution seems to be most effective for the general education of children.

Industrial arts activities may provide one unique contribution in portraying industrial processes. Children can learn the chief characteristics of materials used in factories, the processes by which materials are formed and the operation of the tools and machines. Some method is needed to determine the basic industrial processes. The quarterly publication of the United States Department of Commerce, *Survey of Current Business*, gives statistics that provide this type of information. Tables give the number of workers employed in different jobs, volume of materials produced and other significant data.

These statistics can be grouped to give a comparison of principal industrial processes. The latter can then be labeled to fit into a curriculum pattern. One such study made by Delmar Olson sets up sections for manufacturing, transportation, construction, communications, power and others. This division of industrial processes is particularly successful for correlation with elementary school classroom work. Social studies, science, and language arts use units described by one of the five titles; therefore, the correlation is natural.

The industrial arts activities in the University School on the Northern Illinois University campus are organized according to this pattern. The following illustrations are from the activities conducted during the 1964-65 school year.

A third grade science unit required planting seeds and then transplanting the flowers that grew. The seed flats were constructed by the children using a production and assembly line. Half of the class measured, cut and sanded the parts and the other children nailed them together and lined them with aluminum foil. In about an hour they completed fifteen seed flats. The brief introduction emphasized reading the plans, types of wood used and the value of the factory production method. The next activity, a metal pipe xylophone, for the class, was correlated with music. By using a drill press, a jigsaw, a bandsander and a tubing cutter, each child made a simple xylophone in a short time. The music teacher used the completed instruments in her work with the children.

A fifth grade social studies text described shoe manufacturing in the New England states. It talked about the die-cutting machine crunching through the leather. The children were provided leather and scissors to make a change purse. After completing a purse by hand, an arbor press was set up with a steel rule die for cutting a similar purse. The children were amazed at the speed and accuracy of the die cutting operation. A manufacturing unit in a third grade started with the children slip casting, glazing and firing planters. When the latter were complete they used them to hold the plants they had grown from seeds. This activity culminated in time to have a useful Christmas gift.

The first-graders had completed a science unit on wind and air when an activity in glider construction was introduced. This reinforced their learning about air, provided measuring practice, and introduced the appreciation of air transportation.

The fifth-graders became interested in building construction near the school. A field trip was conducted to illustrate the principal parts of building construction. As a follow-up of this trip, the class collected and identified samples of building materials used in the neighborhood.

Graphic communications was the principal activity for a fourth grade class. Their social studies unit called for making maps of Illinois. The children used them to label the principal cities, rivers, manufactured goods, agricultural products, and population. They screen-printed five different color maps so each child had his own maps to label. After the maps and a cover with an original design were completed the children used plastic loops to bind them into a book.

After the booklets on Illinois were complete the classroom teacher requested help to get the children to make a dictionary. She had not been successful in getting them to make and keep their own dictionary. However, they were so interested in being able to work with machines and tools that they promised to work with the dictionary if they were allowed to make it themselves. They jigsawed a cover from cardboard, glued leather hinges in place and used a drill press to make holes for plastic lacing to bind it. Their pride in having made their own dictionary in that manner inspired them to use it for their language arts work.

Another sixth grade class used the train in their study of power. Before operating the model they studied the generation and utilization of electrical power in the diesel engine. One of the boys brought in a small gasoline generator which they hooked to a light bulb. This also led to the study of the operation of a gasoline engine.

In this way the children of the University School used units in manufacturing, transportation, construction, communications and power to correlate with their other classroom work. They covered their work more effectively by correlating the industrial arts activities to make a direct application of the material in the other subjects and the classroom work was more enjoyable for the children and the teachers.

Introducing Elementary Children to Industrial Process

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ELEMENTARY school education deals with those things which are considered to be the common need of all. It is concerned with those things that tend to unify or integrate people. Some pupils travel faster and go farther, but all are headed toward the same common goal as far as the elementary school is concerned.

Education introduced a humanistic element into the school about 100 years ago for the purpose of aiding the child in adjusting to his social environment. About 60 years ago, a scientific element was introduced to help the child adjust to his physical environment. Paralleling the scientific development, and partly as a direct result of it, has come the most remarkable industrial development the world has ever seen.

Work that was formerly carried on in the home, or conspicuously in a village shop, is now performed behind factory walls. Until a few decades ago, children observed and shared in the work of the family. In many instances they were involved in growing cotton or raising sheep; in cleaning, carding, spinning, weaving, and in making the cloth into garments. Boys and girls today know almost nothing about the production of the clothing they wear or, for that matter, about any product they use. This appalling ignorance of products, occupations, and industries is the concomitant outcome of an education program that does not accurately reflect our culture.

Industry has come to occupy an ever-increasing place of importance in the social, economic, and political aspects of life today. Therefore, there is abundant reason why, in order to help children adjust to the large and tremendously important industrial elements which surround them, an industrial element should be added to the humanistic and scientific element already in the elementary school program.

The term industrial element, as used here, should be understood to include agriculture, mining, construction, transportation, communication, trade, and the services as well as the manufacturing industries. Taken as a whole, these constitute the world's work—the activities at which man spends more than one-third of his waking hours—the means by which he subsists and through which he provides the products and services that humanity uses and enjoys.

I would like to suggest that this industrial element in the elementary school program provide for the development of concepts such as the following: (1) Man is a tool-making and tool-using animal. (2) Man has civilized himself through technology. (3) We live in an industrial-technological culture. (4) Technology improves man's standard of living. (5) Technology produces change. (6) Man works to be happy, useful and successful. (7) All work has dignity.

Most of us can accept these concepts and the tenet that children can and should understand them. Some of us might claim that industrial arts does this. However, I do not see the traditional form of elementary school industrial arts as the subject, or activity, that can introduce this industrial element into the elementary grades. I do not see the provisions for creative experiences, activity, muscle development, study of industrial processes, social consciousness, and the like, as meeting this need. I doubt that industrial arts or any other contemporary school subject can *independently* provide this industrial element. Furthermore, any suggestion that we add another subject to the elementary school program would only make a bad situation worse. Therefore, what I am proposing is more a means or method rather than a subject. There are new subject-matter implications, but they affect the elementary teacher education program more than the elementary school program.

What I hope to identify is a rationale for an industrial element and a means for developing it within the framework of the existing elementary school program. This may seem like an additional burden for the already overburdened elementary teacher, but again, it is more a means or method of attaining the goals of elementary school education than a new body of subject matter. As orientation, let us consider for a moment the group for whom this program is to function.

Most children first encounter a rubber-gloved, masked handler wielding a pair of scissors. They are slapped, wrapped, supped, and burped by other white-robed handlers. In time they are stuck, drilled, transported, clothed, sheltered, protected, entertained, and fed. The consciousness is blended in the stir of humanity as it cleans, cooks, delivers, prepares, beautifies, and builds.

We know that pre-school boys and girls play at being adults. Mama's pots and pan's, father's tools, guns, toy trucks, dolls, doctor's kits—these and other toys help children to emulate a grown-up's world.

When children enter the first grade, they find that school is fun. They paint, draw, letter, count, read, play, tell stories, share things and experiences; they do in school those things that children like to do. They visit the dairy, bakery, fire station, hardware store, and the like. They state that they are going to be firemen today, teachers tomorrow, and truck drivers the day after. They are involved in the many things that adults do and they delight in doing them.

By the time children reach the third or fourth grade, they find that the enjoyable, meaningful school program of the early years has become a regimented, subject-oriented obstacle course. They have unrelated classes in reading, writing, arithmetic, science, social studies, and even their industrial arts is sometimes unrelated. The emphasis is on facts—facts divorced from meaning. The fun of learning about the world they once knew has given way to a frantic effort to acquire high test scores and the further they move through the sequence of grades, the more the problem is compounded.

The specific occupations that boys and girls choose each day while in their early years are relatively unimportant; the significant thing is that they do choose occupations. They choose something tangible that gives meaning to and reason for their activity. They choose something of importance that has been a part of their consciousness since birth—something that continues to be important as they grow older because it is the watershed down which their lives tend to flow. Consequently, occupations (the work one does) and industries (the environment in which one does it) constitute two of the few elements of our culture that affect mankind from the cradle to the grave. Herein lies the key to our problem.

If we could establish the world of work as a structure for education and relate to it the facts, concepts, skills, and values of our culture, I believe that all subjects could become meaningful and vital. Within this framework, the various grade levels would provide integrated units of study dealing with selected industries and occupations: the farm, office, store, and factory; the professional, clerical, skilled, unskilled, sales, and technical workers. The uses of the "three R's" as tools by which these people live, work, and play could thus be meaningfully exploited, even to the extent that drill would become meaningful. Manufactured products and the processes by which they are made would be used to illustrate the applications of facts and principles. Appropriate problem-solving experiences would involve the pupils in the application of facts and principles and in the formation of concepts.

In this setting pupils would be introduced to the knowledge, tools, materials, processes, and people involved in providing their food, clothing, shelter, and other products, and their transportation, communications, and services. Industries and occupations in the community, state, nation, and the world, would become subjects of study and the framework that gives meaning and continuity to all of education. Social studies and science books are beginning to provide this sort of study more and more today.

As an example, let us suppose that a sixth-grade teacher decides to integrate the various subjects he or she teaches into a unit on communications. He would first identify the understandings, values, skills, and attitudes that he wishes to develop in the pupil. Very briefly, they might look like this:

Understandings—The pupil understands how radio and television programs are broadcast; how newspapers are published; how the telephone and telegraph function; how designers communicate with builders; how sound travels; the impact of communications on economic and social progress; the interdependence of workers; the relationships between communications and other industries; social and economic problems created by technology in communications.

Values—The pupil will appreciate the people who provide communications; appreciate the technological development in communications; and believe in the democratic process as a way of life and as a technique for solving problems.

Skills and attitudes—The pupil will work effectively with committees in solving problems; use resource materials and persons to aid in problem solving; communicate the results of his research in an effective manner; use democratic processes.

To institute this unit of study, our hypothetical sixth-grade teacher would guide pupils into raising questions about communications that involve the understanding, values, skills, and attitudes we wish to develop. When the questions had sufficiently structured the class efforts so that the outcomes could be attained, the pupils would then plan the ways in which they would find and report answers to their questions and problems.

Groups of pupils would visit the telephone and telegraph office, the newspaper printing plant, a manufacturer, and a radio and television station. All pupils would use the available textbooks, references, and resource persons. Appropriate teaching aids would be used as the teacher provides instruction.

When a child expressed interest in an occupation he had observed, the teacher would listen and approve. He would encourage and help him to get accurate information about his expressed choice. The teacher would scrupulously avoid reflecting his or her sense of values for the choice. All of this would be done in the interests of providing a subtle form of occupational guidance and to help give reason and meaning to the study. (In later years more determined efforts would be made to help each pupil equate his assets and liabilities with his occupational choice.)

In the classroom, each child would speak and write about his experiences. The history, science, mathematics, technology, geography, sociology, and economics of communications would be explored. To illustrate some of the many principles observed and studied, pupils would plan and prepare demonstrations and artistic displays of objects and information from each industry. Through socio-drama they would perform in various occupational roles. They would plan and construct various devices to help them understand and to illustrate the principles and processes of the communications industries. An industrial arts teacher might serve as a consultant. Some of the devices might be: models of television cameras, microphones, consoles, transmitters, and broadcasting towers; telegraph sounders, blinkers, and telephones. Some of the pupils might print a newspaper or bulletin; others might mass-produce a simple product. The constructional activities would be provided because they help the pupil to understand certain principles and because they offer another medium through which learning may take place. The pupils would use tools and materials just as they use pencils and paper—as means to help them acquire concepts, ideas, facts, knowledge, values, skills, and attitudes that will serve them for a lifetime in this changing world of work.

The unit method of teaching has been used in many elementary schools for years, but few have provided much in the way of a study of occupations and industries. To remedy this situation and to permit the implementation of the program outlined here, some overhauling of the college course in industrial arts for elementary teachers is a necessary first step.

Instruction is needed in the uses of a few common tools and materials. The major need is for involving the prospective teachers in a study of industries and occupations in general and the manufacturing industries and occupations in particular. Such a study should develop understanding of the tools, materials, processes, products, occupations, and problems of industry. As a culminating experience, students should plan an integrated unit of study about some major industry and then perform certain constructional activities that demonstrate their understanding of both the subject matter and the method.

This proposal to orient the school program in the world of work, while neither new nor novel, is based on the hypothesis that the world of work can be used effectively as a framework to unite and direct educational efforts. It stems from a belief that unless the school program accurately reflects work as a part of our culture, it cannot purport to transmit our culture. Without this orientation, boys and girls cannot intelligently select and pursue a program of studies that will permit the development of their maximum potential. Consequently, occupation and industries—the world of work—should be a recognizable influence in the content and structure of the entire school program.

AMERICAN COUNCIL ON INDUSTRIAL ARTS TEACHER EDUCATION—AMERICAN COUNCIL OF INDUSTRIAL ARTS SUPERVISORS

Defining the Role of Industrial Arts Education for the Future

The Definition and Contempory Philosophy of Industrial Arts—An Evaluation and Reorientation in Light of Current Social, Economic and Technological Demands

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THE concepts underlying industrial arts are continually evolving. To attempt to define and establish an ultimate philosophy for industrial arts is as ridiculous as trying to select a particular point of social development and halt all change from that point. Unfortunately, many industrial arts leaders continue to hold tenaciously onto past concepts without subjecting them to careful scrutiny and evaluation. This does not mean that we should discard old concepts simply because they are old, but that we must continue to evaluate and modify concepts to meet the changing needs of our students. Our educational philosophies should be gradually evolving—retaining desirable principles, incorporating the new, and setting aside the ones which are no longer functional. Criticisms such as "You apparently changed your views," or "That isn't what you said before," should be accepted as compliments to a person continually evaluating the changes about him and searching for truth—the true objective of philosophy.

Historically, we have identified with a philosophy which presents industrial arts as representing industry in the general education needs of youth. As a result, its existence has been justified because it contributes to general education. However, the philosophy of industrial arts and the resulting programs have been affected by two factors over which we exercise little or no control—changes in general education and changes in industry. An attempt has been made to keep industrial arts within the framework of general education while the needs of pupils in high school often included programs much broader and more extensive than general education. The result has been a philosophy compressed to the point that practice is much broader than the stated objectives. This is a unique dichotomy, for normally, philosophy encompasses far more than practice is able to accomplish.

Let's take a brief look at the changes which have taken place in definition. Not too long after the title "industrial arts" was accepted, Bonser and Mossman defined this program as "A study of the changes made by man in the forms of materials to increase their values and of the problems of life related to these changes."

Some time later Wilber used the definition, "Those phases of general education which deal with industry—its organization, materials, occupations, processes, and products—and with the problems resulting from the industrial and technological nature of society."

Notice the marked evolution between these two. In Bonser's time, no mention was made of general education nor of industrial materials. These two are important concepts in Wilber's definition. Notice also the consistency which finds *processes, products,* and *sociological effects on society* remaining unchanged.

In recent years we have found additional concepts added to our definition. These include (a) application of the principles of fine arts and sciences; (b) industrial problem-solving; (c) understanding of theoretical principles of industrial mechanisms; for example, electronic components, automation, power mechanics; (d) design and creativity; (e) and other emphases which were part of older definitions but are becoming important due to changes in modern industry. Actually all of these definitions are identifying the same basic point: that is, we simply teach industry and its related technology. Since industry utilizes the skills and knowledges of many disciplines, we find our program becoming an integration of the concepts of many disciplines as they apply to industry and technology. Within this framework, we are able or should be able, to identify a unique body of knowledge which contributes to education.

Now let's go back and take another look at industrial arts as a part of general education. When we first accepted this definition, we found general education to be a broad, organized program of instruction, designed and planned to meet the needs of all students in school. Its primary purpose was to provide students with fundamental and required skills and understanding, encouraging creativity and understanding of sciences and the world about us. Within this framework, Wilber's definition logically fit and gained a reasonable degree of acceptance throughout educational circles.

Today we find ourselves in a world where knowledge is growing at an explosive rate. For the last decade the schools have tried to keep pace with this expansion of knowledge by introducing more and more content into the school curriculum. The result has been a keen competition for school time (with elimination of some very valuable programs) and an emphasis for an elongated school day. Also, general education is being redefined by liberal arts people to emphasize only the humanities and the need to develop a fuller and richer understanding of man's relationship with his environment and interrelationships with each other. Not only do we find industrial arts, physical education, home economics, and those courses which are concerned with American values and attitudes in home and family education, being squeezed out of general education, but we often find the natural sciences, music, and fine arts also being eliminated.

As general education is being redefined, its interest in the natural sciences, fine arts, and applied arts and sciences includes only an evaluation of their effects on our society and environment. The humanities approach to general education tends to discard technical knowledge, understanding of principles and concepts, and retain only the understanding of the effects of this knowledge and the impact of science and technology on our sociological relationships. It is not necessary to understand science, but only to know how it affects us as individuals and how it affects society as a whole. While most of us do not subscribe to this narrow interpretation, we must admit that it is becoming more and more acceptable. It has gained some degree of acceptance in higher education and is being encouraged for the high school program. The knowledge explosion contributes to this philosophy, for it is easily shown that specific knowledge is becoming so vast that to include all new knowledge as a part of the general education of all students is inconceivable. As a result, industrial arts is being pushed to the outside with many other areas that formerly identified themselves with general education.

As we *continually* review our role in public education, we should evaluate what has been happening in the schools and broaden our horizons to encompass and fulfill the needs of our pupils. For years we preferred not to recognize the fact that our classes were crowed with under-achievers and the 60 per cent of the student population that had little or no hope for a college education. Our curriculum planning continued and still continues to emphasize education programs for the gifted. It is conceded that these are important, and current emphasis should continue. We must accept the fact that "our hat of respectability" is based on our educational value to the mentally gifted. Our pre-collegiate and pre-professional programs serve this purpose. However, we must also recognize the needs of the large groups of students who will not go on to college. In the past, school administrators have stated that they were sending them to us to gain occupational experiences.

This can be shown by many examples, among them the television drama, "Mr. Novak." One episode centered in the school's industrial arts program and carried the simple theme that this was the occupational education program for the school. In many instances where administrators are asked to identify the objectives of industrial arts, they identify occupational preparation as foremost.

A critical evaluation of the present and future contributions of industrial arts to the total school program results in the identification of three broad areas of industrial arts instruction:

1. Industrial arts—pre-collegiate and pre-professional education. Includes industrial arts courses designed for the college-bound students, particularly those interested in science, engineering, and technology. This is a special education program planned for the gifted. It is now in existence in many districts. However, it is often exluded from the curriculum for, when considered or tried, it becomes a simple repetition of traditional industrial arts. This is a program on which we must "hang our hat of respectability" and which should be planned to meet the needs of the gifted students found in these classes. It has exciting and challenging possibilities.
2. Industrial arts—general education. Includes the study of American industry and the related industrial society. Even though general education often tends to exclude us as a part of this program, we must hold to our inclusion since, without it, students will fail to gain a true understanding of the contribution of industry to our economic and sociological world. The idea of teaching only the effect of industry on society without having to understand the concepts and principles of industry is fallacious for it creates an over-simplification and fails to recognize and identify many problems created by industry, and possible solutions to these problems. Industrial arts has and should continue to have a place in general education.
3. Industrial arts—occupational education. Includes industrial arts courses of special value to those students who must be employed when they terminate their high school education. This is a recognition of what has been done in the industrial arts program for many years. In general, our objectives have given only brief acceptance to this program. As a result, accomplishment is well below potential. It is very common to hear an industrial arts teacher identify the value of his program by showing how many students are using the knowledge gained in his program either in occupations or as part of professional engineering. This is normal pride and should not be discouraged.

   At the same time, this is not the only function of industrial arts in the school. We should *not* think in terms of a new concept to replace the old; rather, acceptance of the occupational objective as a recognition of the current need and status, and an identification of responsibility. This identification permits evaluation and upgrading of instruction.

   Since many of our graduates use knowledge gained in industrial arts in their work, the occupational function is more significant for industrial arts than for other regular school subjects, with the possible exception of home economics and business. Naturally, this function has implications for the future engineer and junior college technology graduate as well as the high school graduate entering industry.

Returning briefly to trends in the total program of education, it is readily noted that our schools are slowly shifting from broad general concepts to programs of specialization. The principal exception is the continued emphasis on the humanities and the increasing need for depth of knowledge in fundamental skills. After Sputnik, the country became frigthened as a Russian-dominated world was pictured. Our country quickly recognized that world status was based upon strength—strength in technical and scientific advances, identified by products of our educational system. As a result, we embarked upon mass improvement of special education for college-bound students.

The emphasis in the new sciences and mathematics is on identification and encouragement of the gifted. We have often found ourselves preparing students for college while they were still in the elementary schools. During the past two years, an emphasis for special education for the non-college-bound students has emerged. The present unemployment problem, the effects of automation, and spectacular projections into the future emphasize the need for a concentration of education for the high school terminal student. Most predictions show a continual increase in emphasis on education for this neglected group since they will continue to be the center of our economic and sociological problems. It is unfortunate that thinking and planning in these areas have not been as rich and rewarding as thinking in mathematics and sciences. No new approaches comparable with the modern methods of teaching math have been identified. No national foundations or study groups comparable to those in the sciences have been formed to grapple with the educational problems of the 60 to 80 per cent of students not bound for college. Instead, many communities find vocational education programs starting down paths which failed in the past.

As we review national trends, it is not difficult to anticipate a coming emphasis for education for a life of leisure—or education for unemployment. If we fulfill hopes of leaders of the free world and continue to build towards a great society, we will be faced with the reality that there are simply more people than are needed to accomplish useful work. For some time in the future, we will be able to employ additional people in social and education services; recreation and leisure activities will employ many more. However, the tendency for fewer and fewer to produce more and more will continue. It is my hope that this will be accompanied by an organized procedure to reduce the amount of work for everyone, thereby providing more leisure for every person in society. If workable, this would be a far superior solution than lifelong unemployment for many, or for the majority. It is, however, one solution that tends to defy our present way of life and even our system of free enterprise. Even today, the seven-day work week, with morning-till-night activities, is very common for the professional and gifted person while long periods of unemployment and continued leisure are common for the less capable and the young adult. Solutions to these problems and the responsibilities of education require broad, visionary, and imaginative plans by educators who have a thorough understanding of the sociological order of society as well as extensive specialized education. The best planning by the most competent educators is needed to help each person identify his role and find reason and importance in being alive.

Now, back to the subject of philosophy of industrial arts—which simply is the search for and identification of truth, knowledge, and direction. Actually, the weaknesses in philosophical thinking in industrial arts are a minor problem. There is always a need for creative, original ideas to identify the evolving changes in our profession. Our real problems, however, deal directly with the curriculum and methods of fulfilling our responsibility to the student and, most important, the vitalizing and updating of our programs so that we do not continue to find ourselves in the position of providing shallow and outdated programs of instruction.

Imaginative and Creative Curriculum-Planning

The greatest void which our profession has is an organized system for identifying and putting into effect new ideas and imaginative approaches to curriculum. Where are our answers to SMSG, Modern Language Association, and Science Improvement Commissions? Where is our full-time staff of national leaders who promote creative and imaginative curriculum planning—which synthesize the best thinking of our leaders into organized and recognized curriculum, teaching manuals, textbooks, and integrated programs of instruction? Where is our national group that promotes and identifies experimental and imaginative programs in industrial arts for the slow, average, and gifted students? At present, our only answer to these questions is the identification of many capable people working in individual directions to try to solve the problems that face us nationally. The appointment of a national commission for the promotion of industrial arts by the AIAA is a step in the right direction —but only a single step toward a distant goal. We need to identify a sound and acceptable body of knowledge for each ability group and then provide for rapid and continual evolution to meet the needs of education. This requires an organization of the best, meeting and working together often and for extended periods of time. For the present, it is valuable to identify some current and imaginative thinking.

1. Conceptual approach to teaching. This appears to be an excellent approach to synthesize, simplify, and indentify curriculum, especially in light of the myriad of facts resulting from our knowledge explosion. It deserves continual attention by us all.
2. Olson's "New Industrial Arts for a New Culture": This approach identifies industrial arts as a study of technology—using all of its subject matter and values for the purpose of acquainting the student with the technological cultures and helping him discover his potential within the industrial society.
3. New content or subject matter: Recent emphasis has found industrial arts giving major recognition to electronics, fluid power, industrial materials, industrial design, numerical control, automation, instrumentation; plus an emphasis on the complete overhaul of the traditional approaches to industrial processes (woods and metals), graphic arts, and drafting. This

emphasis has resulted in numerous textbooks, teaching aids and devices, and integrated systems combining textbook, projection materials, and teaching devices. Increased efficiency and better learning for the students are the result of these new approaches to our traditional subject matter.

Teaching Competency

Industrial arts programs often represent the very best of the school program, or the very worst. By and large, new industrial arts teachers entering the profession are intelligent, idealistic, motivated, and dedicated young men. All too often, however, their teacher education program has prepared them to teach the industrial arts of ten to twenty years ago. It is not an exaggeration to say that some teacher education situations find "the blind leading the blind."

Industrial arts, more than any other area of education except engineering and science, finds itself in a situation unique in the school program. If we accept the responsibility of teaching industry and technology, and if we then accept a degree of responsibility for leadership, it becomes essential that our teachers remain cognizant of the technical advances of industry. However, in the classsroom, the teacher is the center of authority and knowledge. While teachers often learn from their pupils, it is not possible for student reports and other activities to begin to provide the teacher with information on recent changes and identification of new knowledge in his area of industrial arts. Most of the advances in technical knowledge take place in industry without the knowledge of the industrial arts teacher. Even if well prepared in college, each year the industrial arts teacher falls behind in knowledge in his subject area. This problem of helping teachers keep pace with industrial changes must be accepted and plans instituted which will provide for the in-service education for all teachers. This is true for college teachers as well as for our high school counterparts. There are three avenues which must be developed immediately:

1. In-service education. We should re-evaluate our present concept of in-service education with the thought of eliminating our summer session "hurdle units." A possible avenue is to establish a single and sound salary structure for credentialed teachers with a total elimination of pay considerations for additional college units. Concurrent with this action we should established a sound and continuing in-service education program which would have teachers report for the fall semester one month earlier than they now report. This month would be dedicated to in-service education. In-service programs could be planned by the school's supervisory staff, contracted through teacher education institutes or planned by capable and imaginative members of the teaching staff. The *total* time would be spent in bringing every teacher up to date with the new developments in his subject area and integrating this subject matter into the school program.

   This program could involve field trips, brief industrial work-study programs, speakers, short intensified courses in totally new concepts, industrial instructors, and finally, a curriculum session whereby the new concepts are integrated into existing courses of instruction. This would not be a college credit program but rather part of each teacher's responsibility to his profession. Naturally, he should be paid his regular salary while attending this program, just as industry pays employees for attending compulsory in-service industrial schools. A secondary value would be to establish the basis for a continual bi-weekly series of meetings on maintaining current levels of instruction. Naturally, many obstacles block this idea — money in particular.

2. Increased supervision. Of all disciplines in the school, industrial arts appears to have the smallest number of specialized supervisors. Yet because of rapid changes, the needs are greater than those of most subject areas. Supervisors have the freedom and the requirement to move about their districts and work with the teachers in meeting day-to-day problems and improve curriculum offerings for their students. In most of the cases where we identify an excellent program of industrial arts, we usually find that there is a good industrial arts supervisor in the background. Good supervision alone cannot build good programs but it is a necessary part and, even more important, helps eliminate the very poor programs.
3. Improved teacher education programs. This is a sensitive area but one which needs thorough and realistic appraisal. We must face up to the question of how small colleges with minimum staff and little equipment are able to educate teachers to enter modern industrial arts programs which require high degrees of competency. Is it possible for three- or four-member staffs to provide instruction in all areas of industrial arts? We know these people are dedicated and competent—however, the magnitude of the job is so great that maintaining current knowledge in one area is in itself impossible.

   An immediate solution where we find limited resources and limited faculty might be to train teachers in only one area of industrial arts and let other schools train in other areas. This would result in greater depth of instruction through school specialization. A state with five small industrial arts teacher education programs might find that each of these five programs should specialize in only one or two areas, thereby providing competent teachers in all areas, but simply from different institutions. In any case, industrial arts teacher education needs a strong accreditation structure which has the responsibility of accrediting only programs which are producing qualified teachers. We need standards of the caliber of those identified for engineering, medicine, etc.

Elimination of Conflict

"Peaceful coexistence" not only describes some of our past relationships with Russia but also identifies some of the past relationships between industrial arts and trade and industrial education. Again we find ourselves in a unique position. There is no other subject area in the school that finds two groups of teachers having different educational standards and backgrounds but teaching the same subject—with the objective or potential use by the student being the principal criteria for separation.

In the past, it was not uncommon to find two labs similarly equipped, two teachers with different educational backgrounds—but both programs given the same subject name—drafting, machine shop, automotive, etc. It is not surprising that rivalry, confusion, and open hostility often developed. Over the past few decades, there has been a gradual but steady separation of the programs. In some states we have found a separation by schools—that is, T & I offered in area vocational centers and industrial arts in the regular high school. In other places T & I moved to the 13th and 14th year junior college programs, leaving industrial arts in the high school. However, the recent emphasis by the Vocational Education Act of 1963 and the Economic Opportunity Act of 1964 has resulted in a *return* of terminal vocational objectives to the high school. If traditional programs of vocational education are developed to meet these objectives, the schools will see a repeat of many former problems. If conflicts result, everyone will lose, especially the student.

National interest in the education of the 60 to 80% of the student population unable to profit from college instruction should be met with both enthusiasm for the recognition of the need, and respect for the magnitude of the educational problem identified. This is *not* a time for simple solutions, identifying of spheres of influence, re-using of old ideas, or blundering ahead without careful evaluation. Rather it is a time for creative curriculum planning, careful research, and cooperative efforts in identifying and preparing the most capable teachers to teach well-planned programs of instruction. The simple solution of "Tradesmen—teach your trade," is no more acceptable than the industrial arts teacher educated with six units for an area of specialization—often in labs unchanged for a decade or more. Rather, we need a teacher who has command of his subject area, is cognizant of current trends in industry, and is knowledgeable about the best and most modern methods of instruction.

Overview

As we review our total program and responsibility, we find that in general, our definition and philosophy are sound, but evolving at an unprecedented rate. We must broaden our concepts to identify not only general education, but special education for the gifted, the occupationally oriented, and those having special needs. In order to implement our changing concepts, we must do the following:

1. Promote and encourage imaginative thinking to meet the ever-changing needs of our school population. This can best be done through a strong national structure with promotes and synthesizes the best thinking of the members of our profession.
2. Encourage a rapid and magnified program of sound supervision for industrial arts.
3. Promote a logical solution to the in-service education problem of teachers—as contrasted to the present program of "hurdle units" used by many districts.
4. Develop a sound program of accreditation for teacher education. Develop the standards for excellency—then keep them current and enforce them.

If these four are accomplished, we will have taken the initial steps toward improved curriculum and content for industrial arts. The remaining steps will require a new dedication toward the profession and a continuous desire to meet challenges of a changing industrial world.

What Lies Ahead?

WILLIAM J. MICHEELS, *President, Stout State University, Menomonie, Wisconsin*

"EVERYTHING in the past died yesterday; everything in the future was born today. The future so terribly real waits where it cannot be seen and comes rushing at us like the wind. What does history say of tomorrow? History says tomorrow waits with a big broom. Lincoln said the dogmas of the quiet past are inadequate for the stormy present. We must think anew; we must act anew, 'we must disenthrall ourselves.' When you disenthrall yourself, you break from the bonds that hold you. You cut loose from old traditions and begin to make new ones."[1]

These are the words of the poet. They set forth the theme on which I would talk with you here. I wonder how well you and I in industrial arts teacher education have heeded Carl Sandburg's historical advice? Perhaps you doubt the sagacity of a poet. If so, let me use a quotation from the *Bulletin of the Atomic Scientists:*

"If the human race is to survive, it will have to change its ways of thinking more in the next 25 years than it has done in the last 25,000."[2]

Both of these quotations are generalizations, but they reflect an experience of intellectual awareness, whether it be the poet who accentuates personal feelings, or he who bases his observations on scientific fact.

Where does industrial arts teacher education fit into the picture? That is the purpose of these deliberations. What lies ahead? I wonder.

What is industrial arts teacher education? Is there a structured body of knowledge which this term encompasses and which provides a frame of reference and meaning for any discussion? This is a moot question, but a healthy and wise one in these times. This is especially true if we wish to "disenthrall ourselves" and break from the bonds that hold us, as this may be necessary in looking toward, and planning for the future.

The facts which bear on our problem are many. It is becoming almost trite to talk about "The Challenge of Change," although the facts on the topic are exciting, provocative and sometimes awesome.

You have heard the assertion that our store of knowledge doubles about every 10 years. This may be conservative, but let's accept it, because this allows me to say that there is about 100 times as much to know now as was available in 1900. Do you and I know this much more than our grandparents?

And what about the students we are now teaching? They will be living and working in the year 2000. By then there will be more than 1000 times as much knowledge as there was at the start of the century—knowledge of all kinds to record, to sift, to store, to search out, to teach about and hopefully to use with some degree of sophistication and discrimination.

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[1] Carl Sandburg as quoted in Charles A. Blessing, "Two Cities' Designs for Life in Milan and Detroit," *Graduate Comment* (Wayne State University), IV (October, 1960), 6.

[2] Kenneth E. Boulding, "After Civilization, What?" *Bulletin of the Atomic Scientists*, 1962, 18, 6.

What implications does this have for the courses you are now teaching? The content? The methods? The forms of evaluation? The kinds of learning activities in which your students engage? To be blunt, and in the light of the knowledge explosion, how much trivia is included in your day-to-day exhortations? Have we provided the structure, the depth, the breadth to compete in the marketplace?

In this connection I read two interesting assertions:

A General Electric plant manager found that, without retraining, a third of his 5700 skilled workers would have to be replaced in 10 years because of obsolescent skills.

As to white collar workers, a Westinghouse engineer recently calculated that a graduate engineer has "a half life of about 10 years. Half of what he now knows will be obsolete in 10 years. Half of what he will need to know 10 years hence is not available today."

I wonder what the figures are for industrial arts teacher education?

There is another dimension to this general topic which uses words common in our vocabulary. We talk about helping young people learn about industry. More about this later, but now outsiders are beginning to talk about you and me and our colleagues in other disciplines as being in an industry—the knowledge industry. What are the implications for our area of interest?

The November 1964 issue of *Fortune* described the knowledge industry as a 195-billion dollar complex. Right now it is the biggest growth industry of them all. The dollar value is not nearly as impressive and arresting as the fact that the knowledge industry is growing more than twice as fast as the economy itself. The *Fortune* author, Gilbert Burck, states that it increased 43 percent in five years. Present activity in our Congress suggests that this may be just the start. Are those of us here assembled tooled up for such growth? I wonder.

Throughout the world almost 75,000 scientific and technical periodicals are published in some 65 languages. Each year these periodicals contain almost two million scientific and technical articles. These articles in turn are indexed in about 3000 scientific and technical abstracting journals.

How many of these have you read during the past year? How many of the facts might be pertinent to what we call industrial arts? How many of the isolated facts could or should an industrial arts teacher educator be expected to assimilate? How about your students, and your students' students? How should we be handling this exponential increase of facts?

We talk about an explosion of knowledge. I wonder if this is the best term. An explosion blows and abates. What we have in the knowledge industry is an explosive avalanche which is advancing upon us in geometric fashion.

This is the setting in which we must ask ourselves: What lies ahead? The knowledge explosion is but one factor, albeit basic. Alongside are the population explosions, the technological explosions, the social explosions, the forces of nationalism and the many side effects which accompany these phenomena. We have need for what a political philosopher calls "the acceptance of instability."

This instability takes many forms. We see it on our college campuses in the form of student unrest. We see it in the manner in which traditional job patterns are changing. We see it in the changing concepts of work and leisure. We see it in the various patterns of social unrest that are present, not only in our country, but throughout the world.

Likewise, there is an instability in industrial arts teacher education—and there should be. Our challenge is to accept the fact and build on it. We have heard such things for some time. What have we done about it?

Industrial arts education, as we have known it and practiced it, will soon be a part of the past. For some this will be hard to take, but it will be good. Even those of us in the fraternity have not been able to communicate effectively with each other about what it is that we are and do. We have had some basic ideas in which we believe strongly, but to this point we have not been able to evolve a form and structure which has uniformity, credence and general acceptance. The result has been an eclectic variety of learning experiences coming under the label of industrial arts. Small wonder that school administrators and the general public have little understanding of what we are trying to do.

Is this heretical? I think not. These statements may contain elements of exaggeration, but they are intended only to emphasize the point that we need to disenthrall ourselves, to think anew and act anew in giving structure, pattern and importance to the kinds of learning experiences which we believe in deeply.

The problem facing industrial arts is not a matter of updating here and there. It is more than a quantitative problem of subtracting this and adding that. The problem is that of developing an entirely new structure of knowledge about the ways in which man uses tools, materials, processes and ideas to solve his problems.

We must be willing to eliminate present practices ruthlessly if this may be necessary and desirable. We must profit from the experiences of other disciplines where there has been a willingness to make basic structural changes with a ruthless discard of traditional practices that are not compatible with the needs of the future.

It is heartening to know that some things are happening. A few individuals are doing some thinking and taking some action in a few places. I expect the number has increased in the past year and we will be getting more and more ideas thrown into the hopper. A group of teacher educators is meeting informally at this convention to compare notes, debate issues and make plans. This is healthy. Such is the crucible in which leaders are formed. They will have to do more than talk, but I look forward to the taking of action, also.

These people have strong feelings and a definite belief in what we have stood for in the past, a belief in learning about the use of tools, materials, processes and ideas in solving problems; a strong belief in the potential surrounding what we now call industrial arts. But they believe even more strongly that some changes, perhaps drastic changes, need to be made. They are saying in effect, "We must think anew; we must act anew; we must disenthrall ourselves. In the process we will get at the task of charting the road ahead, testing each assumption as we go along."

From where I sit two distinct possibilities, two paths may be followed by what we now call industrial arts. These paths are different, but they need not be incompatible. In fact, it is my firm hope that as we train our teachers of the future, we can provide them with the competencies to be able to follow either or both paths.

In both cases there will be need for the laboratory, the tools, the materials, the processes, along with ideas. On the one hand a definite structure is evolving, and a body of knowledge relating to the study of industry and technology. On the other hand, I foresee a joining of forces of what we now call industrial arts and what we now call art. This would call for a joining of forces in whatever way may be necessary to insure that young people, all people, learn how to be creative in using tools, materials and processes, to experiment with ideas and to solve problems of many kinds; a study of industry and technology on the one hand, a study of creativeness on the other. These studies need not be incompatible—elements of each are present in the other—but my present thinking is that at this developmental stage they ought to be handled separately, not necessarily by separate people, but as separate entities of structure and subject matter to avoid a muddying of the waters. Let's look briefly at each of these segments —perhaps I should say opportunities.

A few industrial arts teacher educators have been struggling to evolve a theoretical structure of knowledge about the study of industry and technology which would meet the criteria of a discipline. At least two books and numerous periodical articles have been written with this in mind. The structure is not yet clear, but it is emerging. Perhaps several structures will appear before we can decide on the pattern that ought to be followed. Or perhaps we will decide that more than one structure is necessary and desirable, as in the case of biology where several teaching approaches are being tried.

In illustrating these attempts being made to tool up for the future, I must use my own institution, not because it is exemplary, but because I know it best. In the process I will be repeating examples that some of you have heard several times. Several years ago some of our staff members took the position that it was necessary to do more than talk and write about the need for change. They proposed a drastic reorientation for industrial arts and set forth to do something about it. Countless hours of discussions and seminar meetings went into the process of development. A framework was established. The structure was changed numerous times. We gave some people time off to work on the ideas. Along the way I guess I suggested that they call it American industry rather than industrial arts. There may be a better name, but it seemed important to have a new name indicating something distinctly new as opposed to patchwork additions to what had been before.

Outside assistance was received to complete the planning, train ten teachers in an intensive summer workshop, and initiate the field testing. A year of field testing is now drawing to a close. There have been numerous problems, but our staff and the teachers in the field are enthusiastic. They tell me that the structure is imperfect, but basically sound. The approach produces results in the marketplace. Now we are endeavoring to obtain further assistance for the development of more teaching content and additional field testing. Our new proposal asks for assistance in undergraduate teacher education. We will introduce this whether or not further grants are forthcoming.

I am tempted to go into detail, but that is outside the subject of my paper. I have said this much only to illustrate one of the experiments being carried out to evolve a new structure for our study of industry and technology. We are careful to point out that this is an experiment with all that implies.

You may ask how this approach will differ from what is being taught now. There will be a different structure, but a significant difference will be the emphasis on learning broad concepts about industry and technology rather than a concentration on the learning of isolated facts and skills. Let me cite an example which raises the hackles of some of my friends in industrial arts and other forms of industrial education.

The conceptual approach will not concentrate on the development of skills —skill for skill's sake, that is. Skills will be learned, and well, but in a different context from that presently followed. This stems from the fact that we cannot begin to teach people all the manipulative skills which will be necessary or desirable for them to learn as a part of their daily working or living. But we can teach them the best way to go about learning the manipulative skills they may need or desire as a part of their living. If you are skeptical on this point, let me ask how and why you selected the skills which you are teaching the students in your classes? Are they the best skills for each student to be learning?

Let me try to illustrate the point further. Our staff members in the study of American industry have identified three basic concepts relating to the ways in which materials are joined together. They have labeled the three concepts adhesion, cohesion, and mechanical linkage. The objective would be to have students learn the principles which apply to these concepts rather than a few isolated manipulative skills.

To obtain data on this point, a graduate student was assigned the task of identifying as many as possible of the specific operations or skills used to join materials together. He came up with a list of more than 600 different methods which are commonly used in industry. This is an incomplete list, but all of them can be classified under the three basic concepts, adhesion, cohesion, and mechanical linkage.

This is but one example. There must be thousands and thousands of isolated facts and skills which could be included in a study of industry and technology. This is true in every field of study. This is why we must endeavor to evolve a meaningful structure and identify the basic concepts which people ought to learn about industry in a way that will teach them to understand. In the process they should learn how to learn whatever skills and facts may be necessary to meet their differing needs and requirements. They should be flexible in learning the skills which the future will demand.

At this point I am not sure what form a desirable laboratory might take for this type of learning. It is doubtful if there will be wood shops, metal shops and so on, although our people have found that a typical present-day shop can be utilized satisfactorily. I expect there will be many more experimental and testing devices of all kinds, some of which may be made by the students.

A great deal of work will be necessary in the evolvement of learning materials. It is not clear what forms these may take, but it is doubtful if the textbooks of today will meet the needs of the future. This is a real challenge with definite implications for teacher education. They tell me our ten experimental teachers had to struggle last summer, almost desperately, as they worked to prepare preliminary teaching-learning units. Very often they were led into areas of industry about which they had received little or no information as a part of their college training.

There is temptation to add more details, but there is not space. Furthermore, you will have had an opportunity during this convention to hear more competent first-hand accounts of this and other experiments which are now going on.

We come now to the other possible and desirable direction which I would like to encourage—a joining of forces between art and industrial arts. Some industrial arts teachers will say, "We want no part of any attempts at what you call a joining with art. Those guys don't know what they are doing when it comes to working with tools and materials." Likewise, there will be art teachers who say, "Go away, we're already taking care of all aspects of creativity. Besides, your people don't have the proper philosophy."

I expect there are elements of truth in both assertions, but I foresee so many possibilities and so many learner needs which can be better met by a closer relationship. To me this represents an avenue for exciting exploration and development, especially as we look to the future needs of all people in our emerging culture. Artist and craftsman—with the very best that these terms imply, and with whatever meaning you may attach to them. Problem solving, design, creativeness, leisure time—all these, and even more.

Several weeks ago at the Association for Higher Education in Chicago, I listened to Dr. Robert Theobald, a socio-economist, talk about how far behind we are in preparing ourselves for the takeover by computers and cybernation. He repeated what many peope now know, that we will soon be forced to change our entire concept of work. We will have to learn entirely new ways of paying people, as we now use that term.

He went on to say that when the computers have taken over, and it's closer than most of us want to admit, there will be left only four broad areas of human activity:

1. Education—from the cradle to the grave.
2. The human care of human beings.
3. Politics.
4. Self development, in whatever form and direction the individual may desire.

I am not sure that these summarized statements do justice to Dr. Theobald's thesis, but they do help to point out that the creative use of man's time is an important problem with which the future must cope. We ought to be doing something about it now.

A recent *Time* story on "The Computer in Society" talks about the 20-hour work week and the creation of a mass leisure class. The article goes on to state that some radical prophets foresee the time when as little as two per cent of the work force will be employed, which is another way of saying that our whole concept of people as producers of goods and services will become obsolete. The report states, "Even the most modern estimates of automation's progress show that millions of people will have to adjust to leisurely, 'nonfunctional' lives, a switch that will entail both an economic wrench and a severe test of the deeply ingrained ethic that work is the goal and necessary calling of man."

Some people are talking now about a return to the ways of ancient Greece where the citizens had time to cultivate their minds, enjoy their arts, and improve their environment while the slaves did all of the work. The slaves, in this case, would be the computers.

In an intriguing essay on "The Future of Man-Evolutionary Aspects," Sir Julian Huxley, the eminent biologist, charts the paths along which evolution carries man to his future. He writes about many needs, many possibilities, many problems. Toward the end he discusses the new requirements of education. He talks about the need for a new type of integrated curriculum. Then he goes on:

"In addition to a curriculum of subjects, we need something quite new—a properly thought-out curriculum of experience: discovery through projects and travel, through group studies and adventure, through participation in activities thought to be worthwhile. In such ways, education could provide for greater fulfillment as well as for better learning.

"In particular, education in the next phase should pay a great deal of attention to nonverbal education of all sorts. It should help children to explore the possibilities of their own bodies, of perception, of imagination, of creative activity, of the enjoyment of beauty and art. Though art in the broad sense is one of man's major functions, the arts are lamentably neglected in our educational system, especially in its higher reaches."

This is the setting in which I have great hope and faith for a joining of art, industrial arts and other disciplines working together to serve better the creative needs of all people in our society. How should this come about? I do not rightly know yet, but I have hope, which can be illustrated by again using an example from my own institution.

A year ago we established art as a new, major field of study at Stout. We were fortunate in obtaining a dynamic department chairman who came because he saw the potential waiting to be developed. Already he has assembled a small, strong staff and we are on the way. The sculptor came, I think, because he was intrigued by our foundry. We have an artist-in-residence, a distinguished painter from New York who wanted to get back into teaching, but I note he has been snooping around our machine laboratories gathering materials and cuttings of various kinds as a basis for experimentation. Two of the men have been teaching courses in basic design in our department of industrial graphics. Both are artists in their own right. The art metal teacher is a purist—his executions in silver are all handwork except for the buffing. These people are excited about the possibilities of working closely with those who are preparing industrial arts teachers. The same goes for working with those preparing teachers of home economics, although that is outside the realm of this paper.

We have a long way to go, but to me it is exciting. It could be on your campus. I am hopeful that very soon we will have a voluntary series of seminars initiated by our art and industrial arts people to explore this idea of a joining of forces while plotting and planning for the future. This is the way our American industry project got started. I am confident we will have some interesting things to report in the next several years.

This same thing ought to be happening on every campus. And the seminars or discussions should include representatives of as many disciplines as might be interested. Why don't you explore such possibilities on your campus, using the many probes into the future as a basis for asking, "Where do we go from here?"

I have used examples from my own institution because I have had to. I know that some of you, or perhaps many of you, have a potential equally as great or greater. You ought to be exploring and exploiting every possible resource on your campus to get at the business of giving meaning to these two trends; a structure for the study of industry, and working with the people in art and other disciplines to look at meeting the creative needs of all people.

We have much to learn from each other. This applies to colleagues in and out of our special field. Recently it was my privilege to pay a quick visit to the State University College at Buffalo, New York. They have excellent new facilities along with a staff that wants to move into the future. An intriguing fact is that they are housed with the art department. Their laboratories and studios are adjacent to or across the hall from each other. They could take the lead in giving us ideas on this matter of a joining of forces—I hope they do.

Another matter is that of educational technology, which could be the subject of an entire paper. This is a significant part of the knowledge industry—the hardware part. Our literature shows that we have people experimenting in this area. Perhaps there ought to be more, but if we can order our basic structure and know where we are headed, our type of individual will be entirely able to contribute to and take advantage of programed instruction, team teaching, closed-circuit television and so on. This is our meat.

We are still archaic, compared to industry, in defining what we want our learners to be—the kind of product we want to produce. Industry no longer says, "Where can we find the materials to do the job?" Now they ask, "What is needed to get the job done?" Given an answer, they say, "We will create the materials needed." That is how we have reached the moon.

We in education are reaching for the moon, also, but thus far we have not been too successful in defining what is needed to get the job done. It will be a major breakthrough when we are able to describe explicitly, precisely, and meaningfully the kinds of behavior we expect our learners to exhibit as a result of the experiences they have had under our direction.

A major portion of this paper could have been spent in talking about occupational preparation and industrial arts. Certainly this is a timely topic. What takes the place of industrial arts in the future will have a significant role to play. For now, let me state simply that I think here is another instance where we ought to stop fighting windmills and playing theoretical word games about the minute differences between the terms general education and occupational education. Our fraternal literature is replete with descriptions and differentiations. Meanwhile the general public, including school administrators, have little idea what we are talking about. I sometimes wonder if we do. If what we have to teach a young man or woman, or an old man or woman, has merit, let that be sufficient. Let them decide whether they might best use the learning in earning a living or in enjoying life.

Looking ahead, I see significant changes. We will develop a coherent and meaningful structure for teaching about industry and technology. We will be exploring the vast potential of creativity to be exploited by the cooperative ventures of art, industrial arts, and other disciplines. Our content will change; methods will change; our philosophy will change. The laboratory will remain, as will the tools, materials, processes, and, above all, purposeful activity.

We will have to be ruthless as this may be necessary. Certainly we will have to be creative. For this purpose I would define creativity as taking that which we have, that which we know, that which we can do, that which we feel, and doing whatever is necessary to blend these qualities into new patterns which provide the kinds of learning experiences demanded by the future.

As we start in this direction let us again heed the words of the poet:

> Lay me on an anvil, O God
> Beat me and hammer me into a crowbar
> Let me pry loose old walls
> Let me lift and loosen old foundations.
>
> —Carl Sandburg, *Prayers of Steel*

AMERICAN COUNCIL ON INDUSTRIAL ARTS TEACHER EDUCATION

The Evolving Concepts Regarding the Technical and Professional Competencies of Industrial Arts Teachers

Observations Regarding the Pre-Service Technical Education of Industrial Arts Teachers at the Baccalaureate Level

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THE problem of the approach to the best pattern of courses to prepare a technically competent industrial arts teacher is a serious one and does not have one simple answer. As teaching positions are examined they can be roughly grouped into three large categories. First are jobs in the small high school which require an industrial arts teacher to teach part-time in another academic area. The second category involves the small school that can afford one full-time industrial arts teacher. In this position the man is required to teach in a number of technical areas. The third position is found in the large high school. Here the teacher usually teaches full time in one technical area.

It seems to me that it is impossible to have one curriculum to prepare teachers for three different types of positions. It is also impossible for a faculty advisor to decide which way a student should go. The only approach I know is to inform the students of these different types of positions and the opportunities in each and let them decide.

In line with this philosophy we at Kansas State College have three curricula available for industrial arts teachers. One allows a 40 semester-hour industrial arts major plus a 24 semester-hour minor in an academic area. Research has told us that the most frequently used minors are mathematics, science, social science and physical education. The second allows a 54 semester-hour major with no minor. This permits the student to prepare broadly and secure a depth of 6 semester hours in four technical areas plus 16 hours of technical electives. The third is also a 54 semester-hour major with no minor. This permits a 24 semester-hour specialization in one technical area and reasonable preparation, 6 semester hours, in two other areas. All of these have a required core of drafting, design and professional courses.

The most sought-after graduates are those with the area of specialization. It is my firm belief that we are selling industrial arts short by graduating large numbers of teachers who are not strong in any technical area. Technology is our subject matter, yet we traditionally only skim the surface. If industrial arts is to survive we cannot continue to offer busy-work courses taught by teachers who are sometimes technically behind the students in their classes. Today students have technical knowledge from hobbies, science courses and work experience that exceeds that of many degree teachers.

I fully realize there are still many small schools requiring a generalist but these are slowly being eliminated. The best jobs are in the large schools. A recent study by Franklin L. Hoskin showed that those teaching in the smaller schools tended to change positions more frequently than those in the larger schools. In the year 1962, 44.4 per cent of the industrial arts teachers in the smallest Kansas schools terminated their employment while only 12.7 per cent of those in the largest schools changed positions.

An examination of requests for industrial arts teachers at Kansas State College for the last ten years reveals that the percentage of industrial arts teachers teaching outside the field is gradually declining.

Table I

REQUESTS FOR INDUSTRIAL ARTS TEACHERS RECEIVED BY THE PLACEMENT BUREAU, KANSAS STATE COLLEGE, PITTSBURG, KANSAS

	Total No. of Calls	*Full Time I.A. Jobs*	*I.A. Plus Teaching Academic Courses*	*Percentage Teaching I.A. Plus Academic Courses*
1954	219	134	67	30
1955	223	124	64	28
1956	375	279	96	25
1957	318	253	65	20
1958	214	169	45	21
1959	240	191	49	20
1960	338	283	55	13
1961	263	199	64	24
1962	No Data			
1963	210	180	30	14
1964	893	813	80	8

The data in table I indicates that during the period 1954 through 1963, the number of calls for industrial arts teachers placed with our college placement office ranged from 225 to 375. No pattern is reflected by the number of calls. However, the percentage of calls for full time industrial arts teachers steadily has increased. Or conversely, the percentage of calls for industrial arts teachers to teach industrial arts and some other academic area has steadily decreased.

In 1954 we had calls for 219 teachers of which 67 or 30% were to teach in another area. In 1963 we had calls for 210 teachers of which 30, or 14%, were required to teach outside their major.

The data for 1964 are startling and cannot be explained. We had calls for 893 industrial arts teachers (over 4 times that of 1963) and of these only 80, or 8%, required the industrial arts teacher to also teach in an academic area. This trend, through the years, seems to indicate that we should eliminate the academic minor and use those hours to increase the technical preparation of the industrial arts teacher.

What about the technical courses themselves? Where do we as a profession stand? The following are observations and reactions from visiting industrial arts teacher education programs and talking with undergraduate transfer students and graduate students.

Drafting is frequently poorly taught. It does not begin to approach the current practices and problems of industry. Pictorial drafting means isometric to most teachers. Has anyone even seen microfilm or intermediates used? 40% of the industrial arts teachers in Kansas schools are teaching some drafting.

Design is nonexistent, yet permeates our entire area.

How about offset and letterset printing? Do we give any exposure to photomechanical processes? Are we still setting type by hand? How about the chemistry of papers and inks? Only 3% of the industrial arts courses in Kansas are in printing.

Electronics is a rarity in our schools. Even basic electricity is not common. Only 3% of the industrial arts courses in Kansas are in electricity-electronics.

Woodworking is usually all out of date. It is traditionally furniture construction. How about the new adhesives and new manufactured-wood products? How about glue spreaders and electronic high frequency adhesive dryers? We do not expose youth to the vast building industry and the techniques involved. If we do it, it is old-fashioned carpentry instead of panel construction, trusses and glue-laminated members. 25% of the industrial arts courses in Kansas are in woodworking.

In auto mechanics we are tied to the gasoline engine when diesel is equally important. Diesel units are available in the smallest pick-up trucks. How about new prime movers now in experimental stages? 10% of the industrial arts classes in Kansas are in auto mechanics.

The applications of hydraulics and pneumatics are ignored in teacher education and in schools.

Metalworking is traditionally a machine shop or sometimes a sheet metal course. On occasion it is an entire semester of welding. How about basic metallurgy, process instrumentation and tape-controlled devices? 12% of the industrial arts courses in Kansas are in metalworking.

Plastics usually involves cutting off butterflies from extruded stock and buffing them or gluing up cigarette boxes. What is extruding, blow-molding, or pressure or vacuum-forming? No plastics courses are available in Kansas public schools.

You can see that I firmly believe that the industrial arts teacher should be highly competent technically. The undergraduate technical preparation even plagues those of us who try to staff our college faculties. A student with a shallow undergraduate technical preparation is rather useless if he completes a graduate degree and aspires to a college job. I get letters stating, "I can teach drafting, electricity, metalworking and woodworking." This type of person usually has poorer credentials technically than one of our college juniors. It is time that we face up to the serious problem of providing adequate technical preparation for the industrial arts teacher.

Development of Technical Competencies At the Post-Baccalaureate Level

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TODAY as never before in our history, there is a tremendous demand for highly-trained specialists in all fields of endeavor. Certainly the teaching of industrial arts is no exception. There appears to be a trend in American education for students to stay in school for longer periods of time. At one time in our country elementary school education was considered sufficient. Then there was the period when high school was the terminal education for most jobs. We are now passing from the period when the bachelor's degree was the terminal degree to a period when the master's degree is considered the necessary degree for entry into many areas of professional employment. According to the American Council on Education, the annual output of A.B.'s now far exceeds the high school graduates of fifty years ago. This seems to indicate that the A.B. has become almost an accepted minimum for employment above the unskilled level. This fact is substantiated by California's new credential law which makes five years of college mandatory for a standard teaching credential. In a recent survey it was found that one in every three graduates with a bachelor's degree continues his formal education.

With the advent of the five-year college program the question arises as to what courses should be taught in the fifth year and what relationship these courses should have to the baccalaureate program. Before we can determine the answer to these questions it is necessary to trace briefly the development of graduate education in this country and see how it has changed over the years. Although there were occasional courses beyond the baccalaureate level earlier, no true graduate school appeared in the United States until near the end of the nineteenth century. The first real graduate school, Johns Hopkins University, opened its doors in 1876. The faculty for this school was selected more for their success in research than success as teachers. Following the establishment of a graduate school at Johns Hopkins University, Clark University and the University of Chicago established graduate schools. Though the period of time from the establishment of the first graduate school in America to the present time has been less than 100 years, the number has grown from three to over 600 today. Over 100 offer graduate work in industrial arts.

Originally graduate schools were organized with the main emphasis on research and the preparation of college teachers. No one will deny that these are still important functions of a graduate program, but the modern graduate program may be likened to the modern comprehensive high school. It is a multipurpose program with the preparation of college teachers and research just two of the many purposes of the program. Today the graduate program serves the function of up-grading and retraining, as well as providing work for the person who is going to make teaching a career.

People take work beyond the baccalaureate level for a variety of reasons. First, perhaps, is the individual's desire to broaden himself. One of the characteristics that has been ascribed to graduate education is the broad range of work available to the individual. This aspect would be an important consideration for the person interested in expanding his knowledge.

Another reason people attend graduate school is to expand their knowledge in their chosen field of work. This is probably one of the most important functions of graduate work in industrial arts since the explosion of technology makes it all but impossible to present enough depth in technical areas at the undergraduate level.

Another important consideration for teachers is the requirement for either graduate work beyond the bachelor's or a graduate degree to attain the highest step of the salary schedule. Many school districts are virtually forcing their teachers to enroll in graduate work by the nature of their salary schedules. Closely allied to this is the provision in many states that to attain a permanent or professional credential to teach, the teacher must have either a fifth year of school or a graduate degree.

All of the previous considerations are as important to industrial arts teachers as they are to English teachers or history teachers.

However, the area of industrial arts is unique in several ways. I have touched on one problem, that of gaining sufficient depth in a technical area to be a competent teacher of that subject. Another problem unique to industrial arts teachers is that of keeping current in their subject. In addition to keeping proficient in the technical areas there is the problem of keeping up with the latest in educational methodology, philosophy and the changing concept of industrial arts. It is obvious that the graduate program in industrial arts, to be really effective, is going to be quite different from that in the liberal arts.

Let us now look at specific features of graduate work in industrial arts. One of the more important characteristics of good graduate programs in industrial arts is flexibility. This allows the advisor to work out a program of studies with the student tailored to individual needs. This is a most important point when considering the development of technical competencies at the graduate level.

According to a study conducted by Dean and Lathrop for the 10th yearbook, graduate programs in industrial education have changed in recent years. Now there is more opportunity to secure courses in technical areas of specialization at the graduate level. The typical graduate program appears to be the one which meets the needs of its students and is suited to the individual.[1]

Here let me emphasize that I am not talking about making up undergraduate deficiencies in a technical area by giving credit for technical courses at the graduate level. It goes without saying that a good graduate program must be based on a sound undergraduate program with enough work in the technical areas to incur depth of subject matter as well as breadth.

There have been several studies in recent years that have attempted to study the graduate program and the relationship of technical courses to the total graduate offerings. Armin Gimbel conducted a study in 1953 in which he attempted to ascertain the status of the practice of granting credit for manipulative work at the master's and doctor's level. He found that one-third of the respondents felt a need for more manipulative training at the graduate level. In addition 91 per cent of the respondents indicated they would prefer doing master's work at a school where manipulative work was offered for credit at the graduate level. The majority of the department heads and college teachers who responded stated that industrial arts students should have preparation in at least four areas of technical work with at least 7-9 semester hours in each area. Gimbel concluded that the four-year program was not adequate for industrial arts teacher education.

Another study reported four years later in 1957 by Roy A. Wigen also attempted to identify the amount and kind of technical courses that were being offered at the graduate level and to develop a guide to help administrators determine the adequacy of their programs. In gathering data for the development of the guide he found that the scope of learning experiences in technical offerings at the graduate level is very broad. Technical courses at this level should include the understanding and interpretation of an industrial society, not merely manipulative work. Wigen also stated that a graduate program needs to have flexibility so that it may be shaped to the needs of the individual.

One of the latest studies concerning graduate programs was conducted at the University of Missouri by Richard E. Ginther. There were several findings and conclusions in that study which are pertinent to the problem of manipulative work at the master's level.

A little over three-fourths of the institutions included in the study offered graduate work in technical or skill types of courses in industrial education. The most frequently indicated technical areas were metals, electricity, drafting and woods. The range of semester hours offered for the technical areas was between

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[1] C. Thomas Dean and Irvin T. Lathrop, "Examples of Graduate Programs in Industrial Arts," *Graduate Study in Industrial Arts*, 10th Yearbook of the American Council on Industrial Arts Teacher Education (Bloomington, Illinois: McKnight & McKnight, 1961) p. 133

1 and 30. The mean number of hours offered, per area, for all areas, was 5.44. The mean number of semester hours offered in technical or skill courses by the institutions reporting was 29.73.

Ninety-seven per cent of the graduate technical courses in industrial education were reported to consist of a combination of manipulative and related content as against courses devoted entirely to either manipulative or informational content. About 50 per cent or more of the class time in combination courses was devoted to manipulative work.

Less than 40 per cent of the respondents indicated that graduate students were required to take some technical area courses. The range of required semester hours in technical courses was between 0 and 20. The mean was 9.78 in the institutions reporting required hours in technical courses. The number of hours recommended in technical courses was considerably greater than the number of hours actually required in such courses. About 70 per cent of the respondents indicated that technical courses were recommended to be taken by graduate students. A little over 21 per cent of the respondents indicated no recommended hours in technical courses at the master's level. The range of recommended hours in technical courses for the master's programs was from 0 to 24, with a mean of 8.91. The mean number of recommended hours for the specialist programs was 14.22. Respondents from 80 per cent of the graduate programs indicated that semester hours earned in technical courses were accepted for graduate credit.

The portion of time actually devoted to the development of specialized technical or skill competencies in the master's programs was considerably less than the time the respondents believed should be devoted to this function. The respondents indicated that they believed less time should be spent in the development of teaching and administrative competencies at this level.

The portion of time actually devoted to the development of specialized technical or skill competencies at the doctoral level was less than half of what the respondents indicated they believed should be devoted to this function.

Since the portion of time actually devoted to the development of specialized technical competencies at the master's level appears to be considerably less than the time believed to be necessary for this purpose, an increased number of provisions for developing specialized technical competencies are probably needed, if graduate students are to gain skill and knowledge in their technical areas of specialization, which are in increasing demand in the better school systems and colleges. These added provisions would include both facilities and depth of course offerings in all areas of specialization.

The most recent study of practices at the graduate level was conducted by Wendell L. Swanson and attempted to study several phases of graduate work, one of which was the relative importance placed on general education, professional education, technical education and research. The findings indicated that in most cases graduate credit was given for technical courses.

From the available information the following conclusions seem justified:

1. Schools offering graduate work have a responsibility to provide a certain amount of technical work at the graduate level.

2. This work should definitely be of graduate caliber, not merely undergraduate courses in which graduate students are placed.
3. The technical courses for graduate students should encompass problem-solving, research and development, as well as advanced technical information.
4. Evaluation of graduate students in technical courses should be based on the ability of the student to tie processes together into a meaningful whole; i.e., the ability to evaluate and select certain processes and materials for their adaptability for the job at hand. This would imply a certain depth of technical knowledge as well as planning and knowledge of economic factors related to industrial applications.
5. On the basis of the findings of Ginther's study, it is recommended that the number of semester hours of course work devoted to the development of specialized technical competencies at the master's, specialist and doctoral levels in industrial education should be approximately as follows: Master's degree, 10 hours; specialist certificate, 20 hours; doctoral degree, 18 hours.

I would like to close with two statements which have implications for all levels of industrial arts but especially for the post-baccalaureate level: Almost every person in the present labor force will have to be retrained 3-5 times in their lifetime. Seventy-five per cent of the people working in factories in 1975 will be making products not yet invented today.

Student Ability Levels: Implications for Methods in General

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THE topic of this paper has some resemblance to the discussion of what would happen if an immovable object were to be struck by an irresistible force. We can conceptualize some of the components of each according to various theoretical models, extrapolate from accepted principles and support our arguments from controlled research findings; any discussion or conclusions will have to be tentative and selective. Philosophical orientations and assumptions accepted by the discussants cannot be ignored and are not likely to be adequate or appropriate to the answer needed. The differences in ability levels, and methods, do not appear as a common linear scale—there are differences in kind as well as in degree.

In another sense, methods and ability levels are like the weather. Everyone talks about them, but there is little done about them. There is even a good measure of disagreement about what actually constitutes methods or ability levels (—or, is it partly cloudy or is it partly sunny?)).

In recent years there has been an increasing concern among educators and learning theorists about the most effective and efficient means of obtaining the objectives of an educational program. The human being is the most complex assembly of components, control systems, ideas, values, and motivations in existence. Any objective stated in language broad enough to cover a total group must be so complex as to prevent identification of variables sufficiently isolated to allow direct investigation. When the teacher, the educational psychologist or the experimental psychologist attempts to investigate the influence of a selected variable they are forced to assume that all other influences are equal or are controlled. Such an assumption may have merit with mice in a maze or flatworms in a tank, but students in a classroom simply do not conform to the requirements of desirable scientific subjects.

All kinds of parents, from all kinds of homes, send us all kinds of children. They send us the best they have, even though this may not be as good as the parents themselves would wish. All of the ones you get in your classes will not be the best; but, as good or as bad, as alike or as different as they may be, we have an obligation to accomplish as much as we can by using the best evidence available in determining our approach of method. The task is further complicated when we must attempt to prepare these students for the certainty of uncertainty.

Teaching methods historically have been determined more by philosophical influences than by scientific investigation. The points of view of Froebel and Rousseau are still evident today. The basic theme is that there is a tendency for the child to develop through natural phases if the proper environment is provided. The teacher should help to facilitate this environment by being permissive and allow the development to occur without undue interference. There was a wholeness and unity in the natural law.

Other teaching methods have developed on the basis of the role that the teacher should fulfill in the classroom. Based on developments in clinical psychology, some would propose that the teacher should have many attributes of the therapist. A method based in this context would bear little resemblance to the teacher of another era who saw his role as one of the stern disciplinarian who must control the "devil's handiwork."

The needs of the individual teacher and his background and values may be a more powerful influence in determining his methods than will his knowledge of learning theory or professional education. A particular method may be adopted through the need for absolute control of the situation in the classroom. The authoritarian classroom may be a more necessary condition for the individual teacher than a requirement for learning.

Changes in philosophy have also been reflected on the authoritarian-democratic dimension of teaching methods. The "progressive" education movement in the 1930's with its activity approach led to many studies of this variable.

The values and attitudes of a particular school and the community in which it is located may so influence the total school atmosphere that a particular method must be followed to a marked degree in each individual classroom. A single teacher attempting to utilize a particular method different from those of all the other teachers, regardless of its success in another situation, may create anxieties in the students which interfere with the learning process.

The entire question of grouping students according to some type of ability measure was primarily a philosophical issue until the late 1940's. Segregating students on the basis of ability was "undemocratic." Grouping had an undesirable connotation or stigma associated with it because grouping typicilly meant separate classes for the slow learner. After Sputnik and the hysteria for science and mathematics, the emphasis shifted to the gifted. The undemocratic issue was completely submerged by the high-status attraction of the special classes for the gifted.

There is no question but what any teaching method must be grounded in a philosophy. The philosophy determines the objectives and values to be obtained and different methods may be more appropriate to each set of values. However, once these values have been determined, the method should make use of the available scientific knowledge about learning.

It is the philosophical orientation of the present that brings ability levels under consideration. At the turn of the century only about ten per cent of the age group attended school for any extended period of time. They were of "high" ability and conformed to a predetermined pattern or they left school. As we approach 100 per cent school attendance through high school we must provide for the multidimensional abilities represented by all students. The schools have been able to live in an unrealistic and protected environment by establishing cut-off points on each dimension. Attempts to apply the methods that were adequate, or at least tolerable, to the select group have met with many failures when applied to those beyond the previous cut-off points. Additional pressures are coming from the realization that a higher level of success is necessary, and possible, through a more scientific and vigorous approach.

Considerations of ability levels generally are concerned with the intellectual or cognitive dimensions. In the early years of intelligence testing, ability was measured as a single factor and expressed by a single index. The more recent recognition of the multifactor structure of ability allows a much more comprehensive approach to the investigation of relationships between ability levels and methods. A number of models have been proposed as conceptual structures and tools for the identification, study and understanding of abilities and ability levels.

Intellectual abilities are only one type. Physical abilities are of particular interest to industrial education. In this area of ability we must also be concerned with multifactor or multidimensional considerations. Motivation, dexterity, strength, auditory, visual, and other physical-health variables must be considered in developing a method. The study by Fuzak suggests many potentially fruitful areas of investigation.

In recent years many studies have been designed to identify, measure and develop problem-solving ability and creativity. The relationship between intelligence and creativity has not been clearly established. How may we distinguish between the creative activities of all persons and the truly creative individual? More importantly, what methods are most effective in facilitating the development of the potential of an individual's abilities in this domain?

Social, economic, cultural and personality factors may also be considered in the same general context as intellectual and physical abilities. Certainly they are variables that must be recognized and provided for within any method. Our terminology gives direction and relative placement on a scale to each of these variables, or abilities. Culturally deprived, delinquent, emotionally unstable, poverty stricken, anti-social and other descriptive classifications are similar to intellectually able, slow learner or physically handicapped. Motivations, self-concepts and personal goals are distributed over an entire range and are at least somewhat independent of all other variables.

Within such a complex and dynamic structure it is not surprising that relatively little sound research has been devoted to teaching method. The findings of learning theorists are also difficult to apply. Most of the principles of learning are extensions and translations of animal learning experiments or the most closely controlled human learning experiments, There is little sound basis for assuming that meaningful learning in a dynamic classroom occurs according to the same principles found in studying nonsense syllables or paired adjectives, or hungry animals searching for food.

However, even with these limitations, surprisingly little has been attempted in applying scientific methods of research to developing teaching methods. No comprehensive attempt has been made to develop a teaching method on the basis of available scientific learning studies. The scientific approach and research techniques are only now being developed and applied to the problem of teaching methods.

There have been many studies that have attempted to compare a "traditional" method with some newer methods. In general the methods have been defined in gross terms and the variables under investigation determined more on an *ad hoc* basis than as a result of previous research efforts. Such studies result in an attempt to compare two situations where there are more unknown than known variables. Also, the instruments, content and experimental situation lack precision and known reliability and validity. Other typical features in such studies have been an extremely short time for both the experimental treatment and delayed testing. The proportion of the total learning time devoted to the experimental method has been very small in comparison to the formal learning sessions of the subjects outside the experiment.

In many cases the researcher has entered the study with a preconceived idea of the method, content, and result. His problem has then become one of attempting to find a psychological orientation sufficiently compatible, by his own reasoning, on which to hang his study. Many such studies have been conducted by masters or doctoral candidates. The practice has served the objective of providing a desirable learning experience for the candidate. Few such studies can be considered significant or to have produced findings significant in developing a method of teaching.

The secondary benefits of such studies are probably of much greater benefit. An atmosphere of inquiry and questioning is facilitated for the investigator, his colleagues, and his subjects. It is a method in itself and a most desirable one. Investigations in any new area or field must pass through the stumbling phases before adequate guidelines and variables can be established.

Practically all studies have some general results in common. Subjects with higher measured intellectual ability learn more, faster, make a more and better transfer and retain it longer. If one method is found to be superior, it will be superior for all ability levels. I have been unable to find any adequately controlled study which shows a consistent and significant interaction between ability and method. There are literally hundreds of studies that report no interaction of these variables. A few incidental interactions have been reported but they appear to occur at, or below, the level that could be expected from chance alone.

A second common result has been the significant and consistently higher achievement obtained per unit time of experimental treatment than that obtained in the typical classroom. The detailed considerations and preparation of the learning passage may account for most of this unusual gain. The so-called Hawthorne effect may also account for a significant amount of the advantage found in experimental studies. A number of writers have raised a similar question concerning the success of programmed instruction and teaching machines.

A great many studies have shown programmed instruction, television, discovery methods, audiovisual devices and other newer methods to be as effective as so-called traditional methods. We have probably reached the place where we can accept this finding and devote our effort to a more detailed consideration of which media or method is more effective for which kind of content and for which individual. A combination of methods will probably always be necessary for complex content and complex individuals. At present we must rely on opinion and preferences. A recent bulletin by the U. S. Office of Education reports a summary of opinions on the choice of methods for students of high and low ability. The commonly expressed opinion appears to be contrary to practically all research evidence.

Anyone who attempts to develop a method of teaching based on learning theories is immediately faced with a choice of which theory to select. There is general agreement on a number of basic principles, but these are not adequate to implement a particular method. Theorists may agree on *what* happens but disagree on *why* it happened. It may not be possible to determine the "why," but use of a conceptual model may facilitate formulation of a consistent method. Learning cannot be measured directly; we must depend on behavior changes and responses to indicate the internal conditions and changes.

Cognitive theorists have been questioning many traditional findings and interpretations in recent times. Their research evidence and a re-evaluation of past evidence raises new issues. Many of their studies and theories have been devoted to meaningful, verbal learning, but the implications would appear equally appropriate to other kinds of learning. Content cannot be transmitted directly to the learner. Each learner receives new information into an existing cognitive domain. Consideration must be given to the nature of that domain as a result of past experiences and the present situation. Ausubel and Fitzgerald have reviewed many of the studies, findings, and positions of these theories.

In general, cognitive theorists propose that the teacher must help the learner organize his existing cognitive domain in such a manner that the new content may be appropriately organized into content and relationships. The content must be presented at the appropriate level of sophistication to achieve attachment to existing principles, generalizations and expectancies. Content that is inconsistent with the existing domain may be short-lived and easily repeated but not assimilated, therefore resulting in a lower level of learning. If the material is too different anxieties may develop which prevent learning.

The learner must be an active participant in the learning process. He must have the opportunity to receive the content, process it and integrate it into his total structure. A convergent method where the teacher controls the presentation and limits the discussion may prevent the learner from making his own comparisons, trying alternate hypotheses, seeking clarification of errors and reorganizing his cognitive structure. A method based on the cognitive theory would transfer much of the responsibility for questioning and restructuring of the content to the learner. The teacher would have to make more extensive preparations to be able to structure the classroom situation and atmosphere for the desired results. Again, the method would be the same for all ability levels, but the level of approach would differ.

Any consideration of method must also concern itself with content as well as objectives. The *Taxonomy of Educational Objectives; Cognitive Domain* presents a most valuable model and tool to assist in the development of appropriate methods. It may be that there is a more important relationship between the level of content, as outlined by Bloom, and method than there is between the ability level of the learner and the method employed.

The taxonomy uses six levels of objectives, or content, organized in a cumulatively dependent, hierarchial order. A brief outline will illustrate the structure:

Knowledge

1.00 Knowledge
    1.10 Knowledge of specifics
    1.20 Knowledge of ways and means of dealing with specifics
    1.30 Knowledge of the universals and abstractions in a field

Intellectual Abilities and Skills

2.00 Comprehension
    2.10 Translation
    2.20 Interpretation
    2.30 Extrapolation

3.00 Application
    The use of abstractions in particular and concrete situations.

4.00 Analysis
    The breakdown of a communication into its constituent elements or parts.

    4.10 Analysis of elements
    4.20 Analysis of relationship
    4.30 Analysis of organizational principles
5.00 Synthesis
    The putting together of elements and parts so as to form a whole.
    5.10 Production of a unique communication
    5.20 Production of a plan, or proposed set of operations
    5.30 Derivation of a set of abstract relations
6.00 Evaluations
    Judgments about the value of materials and methods for given purposes. Quantitative and qualitative judgments about the extent to which material and methods satisfy criteria. Use of a standard of appraisal. The criteria may be those determined by the student or those which are given to him.

Methods in the past have concentrated on teaching and testing the elements at the lower levels of taxonomy. They are more easily identified and demonstrated. However, learners in the lower ability levels must operate in a world where they will be required to make judgments—within their own limits. Methods must be developed which will make it possible for each ability level to make the best judgments within their potential.

We are just entering the time when scientific findings have reached a point where we can develop appropriate methods of any kind. Certainly they are not sufficiently refined to show differential effectiveness for various ability levels as determined on any of the many dimensions. The philosophy and values of our time demand that the classroom and laboratory practices have a sound base rather than reflecting the elements and needs of the situation without regard to scientific evidence and investigation. Our schools are committed to serving all the young people of our society regardless of their patterns of ability. Appropriate methods can be developed but they are not known today.

Student Ability Levels—Implications for Specific Methods

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THERE appears to be unwarranted and perhaps naive optimism implicit in the title of this paper—"Student Ability Levels—Implications of Specific Methods." First of all, *student ability level* implies some sort of one-dimension attribute that can be precisely identified and quantified. The attribute *ability* is, in fact, multi-dimensional and has meaning only when it is discussed in a particular context. Among the identifiable but not always readily-measured variables relating to ability are the following: Intelligence, personality, creativity, attitudes, aptitudes, interests, volition, level of aspiration, value sets, and perceptual sets.

It would appear that far too many people think only of the one-dimension intellectual ability as measured by such instruments as the Stanford-Binet, Wechsler, or Thorndike-Lorge intelligence test, when assigning labels that purport to quantify the attribute *ability*. There are at least two reasons why this single index is not a valid measure of the attribute ability. Gallagher (1960) points out that tests of intellectual ability do not, at the present time, include measurement of such intellectual characteristics as creativity and verbal fluency. Torrance (1963) indicates that about 70 per cent of those scoring in the upper 20 per cent on measures of creativity will not be found among the top 20 per cent on an intelligence test. Getzels and Jackson (1958) were able, in one study, to indentify two mutually exclusive groups, one with high scores on a battery of creativity measures but not with high IQ's, and one with high IQ's (upper 20 per cent) but not high on measures of creativity.

A second reason why the IQ alone is not a valid single index for the attribute ability stems from the variability among different measuring instruments as well as variability from one test administration to another.

Conceding then that ability is "a many-splendored thing", and that the labels, "high ability," "medium ability," and "low ability" are in themselves meaningless unless related to a set of conditions, research indicates that it is possible to obtain such measures and that it is possible to relate such indices of ability to the conditions which answer the question, "ability for what?" It is beyond this point, however, where the way becomes less clear. This relates to the second part of the title of this paper, "Implications for Specific Methods."

Over the past thirty or more years there has been a considerable amount of research which has attempted to discover the relationships that appear to obtain between the teacher, the learner, the learning environment, and the total social structure. A review of the research dealing with these aspects of teaching and learning lead one to the inescapable conclusion that the interaction of these variables is extremely complex and in most instances, not consistently predictable.

Bloom points out that there is no intrinsic goodness or poorness in teaching and learning experiences but rather it is the effect of such experiences upon the learner that is good or poor. Evidence to support this point of view is found in the inconsistent results of experimental studies purporting to compare methods of teaching. Bloom suggests that different teaching methods may elicit similar learning processes on the part of the student. To add further to the confusion, Wallen and Travers state that teaching methods should not be considered to be the products of scientific research because it has only been in the last few years that scientific knowledge has begun to reach the point which will permit the systematic design of behavior patterns for teachers with which to maximize the achievement of students with respect to specific objectives.

Arguing that since teaching methods have arisen largely outside of a scientific context, Wallen and Travers suggest that research attempting to compare one method with another is analogous to the medieval physician attempting to compare the curative powers of two herbs when he has no knowledge of the chemistry, physiology, or pharmacology involved. It cannot be said that many of such studies lack sophistication as far as statistical techniques by which hypotheses are tested but such statistical sophistication cannot make up for what Wallen and Travers term "the theoretical naiveté reflected in the concepts involved." This is not to suggest that all research on teaching has been ill conceived, poorly executed, and generally worthless. It does suggest that before such research can become meaningful the nature of the learning experiences must be carefully described and defined outside the labels of methods such as lecture, experimentation, problem solving, project method, team teaching, programed learning and the like. Thus the learning situation must be described not only from the viewpoint of the teacher but from that of the learner as well. That this has been largely neglected is amply demonstrated in the research reported to date.

So far, a rather dismal picture of the current state of affairs existing between the matching of ability levels and teaching methods has been projected in this paper. You may have reached the conclusion, at this point, that there does not appear to be much research evidence to support the notion that there is a relationship between teaching methods and ability levels. I believe that this is largely true. For example, we might infer that problem-solving approaches involving discovery or directed-discovery would be largely in the province of the high-ability student and yet we can find experimental evidence which suggests that this method may be effective at all levels. This is not to say that adaptations do not need to be made when using this approach with low-ability students as opposed to high-ability students. The adaptations, however, are usually in the subject matter rather than the method. This is largely true of the other so-called methods. Experimentation, the project method, team teaching, programed learning and others have been used with varying degress of success with all ability levels. The principal adaptations that have been made in deference to ability levels have been in content and time allocations.

It would seem then that teaching methods are more closely related to the objectives of the learning process than they are to the ability level of the students engaged in the educational transaction.

Hilgard has pointed out that even though there does not exist at the present time a systematic theory of psychology satisfactory to all psychologists, there is, nevertheless, a great deal of empirically-derived knowledge about learning which is independent of the major points of view. Burton has identified some 22 principles of learning which have been supported through experimental findings:

1. The learning process is experiencing, doing, reacting, undergoing.
2. Responses during the learning process are modified by their consequences.

3. The learning situation is dominated by a purpose or goal set by the learner, or accepted by him, and should lead to socially desirable results.
4. The learning situation, to be of maximum value, must be realistic to the learner, meaningful, and take place within a rich and satisfying environment.
5. The learning process occurs through a wide variety of experiences and subject matters which are unified around a core of purpose.
6. The learning experience, initiated by need and purpose, is likely to be motivated by its own incompleteness, though extrinsic motives may sometimes be necessary.
7. The learner will persist through difficulties, obstacles, and unpleasant situations to the extent that he deems the objectives worthwhile.
8. The learning process and achievement are materially affected by the level of aspiration set by the learner.
9. The learning process and the achievement of results are materially related to individual differences among the learners.
10. The learning process proceeds most effectively when the experiences, materials, and desired results are carefully adjusted to the maturity and background of experience of the learner.
11. The learning process proceeds best when the learner can see results, has knowledge of his status and progress, when he achieves insight and understanding.

12. The personal history of the learner—for example, his reactions to authority—affect learning outcomes.
13. Tolerance for failure is best taught through providing a backlog of success that compensates for experienced failure.
14. The learning process proceeds most effectively under that type of instructional guidance which stimulates without dominating or coercing; which provides for successes rather than too many failures; which encourages rather than discourages.
15. The learning process in operation is a functioning unity of several procedures which may be separated arbitrarily for discussion.
16. The learning products are socially useful patterns of action, values, meanings, attitudes, appreciations, abilities, skills.
17. The learning products accepted by learners are those which satisfy a need, which are useful and meaningful to the learner.
18. The learning products are incorporated into the learner's personality slowly and gradually in some instances, and with relative rapidity in others.
19. The learning products when properly achieved and integrated are complex and adaptable, not simple and static.
20. Transfer to new tasks will be better if, in learning, the learner can discover relationships for himself, and if he has experience during learning of applying the principles within a variety of tasks.

21. There is no substitute for repetitive practice in the overlearning of skills or in the memorization of unrelated facts that must be automated.

22. Spaced or distributed recalls are more advantageous in fixing material that is to be long retained.

A close examination of the experimentally derived principles of learning reveals that they appear to be independent of ability levels. For example, if responses during the learning process are modified by their consequences, this will be true whether the responder is of high or low ability. The principle suggests that a method of presentation be such that the learner will be apprised of the consequences of his responses. In terms of specific methods, this suggests programed learning. The low-ability student may require more trials than the high-ability student but this is a difference in content, not in method, as it relates to ability level.

Rather than spend time and effort in a questionable search for methods that relate to ability levels, it would seem more fruitful to analyze the principles of learning with respect to their implications for specific methods. The first procedure seems to be a preoccupation with techniques, gadgetry, or rules-of-thumb while the second tends to justify practice in terms of theory. Research along these lines may well lead to a systematic theory of teaching-learning, a necessary requisite to the development of the effective teaching methods of the future.